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ELECTRIC LIGHTING ACTIVITY.

Last April we called attention to the fact that the returns compiled for the McGraw Electrical Directory of central stations showed a gain for the year 1907-8 of no fewer than 485 plants, of which 256 reported their capitalization to the amount of $62,619,565. It was also shown that 265 of these plants belonged in the second half of the year under report, proof of a sustained activity and cause for encouragement. It would seem that the current year continues to furnish marked gains. For example the June additions indicate a total of 47 new private plants and 10 municipal plants. The 26 private plants giving their capitalization aggregate $17,518,600 while the 9 municipal plants reach a total of $509,000. These are excellent figures, affording ample warrant for optimism as to the rising tide of a new prosperity. They would seem to run above the averages of the past year, but it might not be quite accurate to apply the limit of just one month to them, some of them possibly belonging to May. On the other hand, June might not get credit for all its own new incorporations, owing to delay in registering them, so that, after all, the June showing must be taken as a splendid indication of getting "ready to serve."

At this juncture it may not be amiss to emphasize the point that this is a very good time to buy plant and apparatus. Copper seems to be at the bottom of its depression in price, and at current quotations, wire, dynamoelectric machinery, transformers, etc., look very attractive. Political changes have been discounted, the crop outlook is bright, stocks of goods are low, and the reasonable inference is that now is a good time to file orders.

CAPITALIZATION OF A FRANCHISE.

In denying the application of the Long Acre Electric Light & Power Company for authority to issue securities, the New York Public Service Commission, First District, assigned as its most important reason of public policy for the rejection the economic waste which would be caused by the duplication of capital investment and ensuing competition. Other reasons, embodying principles of almost equal importance, concerned in substance the proposed financial arrangements for construction of the plant, the validity of outstanding issues of securities on the property and a collateral question, the capitalization of franchises. Some aspects of the decision were discussed in our issue of July 4, in which an abstract of the report of the commission was also published.

We approve in general the grounds on which the commission rejected the endeavor of the company to set up competition in a congested district of New York City, the expense of which would be borne ultimately by the public; but we think that the decision does not clearly represent the intent of the law on

one point. The commission questioned the legality of the outstanding issue of $1,000,000 bonds, which it was proposed to retire with part of the proceeds of the new issue. It appears that the company had issued $1,000,000 bonds, and also $50,000 stock, without the approval of the Commission of Gas and Electricity. The act which created that commission provided that it should approve all new issues of securities by corporations under its jurisdiction. As this approval had not been secured, the Public Service Commission felt doubtful concerning the legality of the outstanding securities. If the securities were not issued lawfully there was naturally a question as to the goodness of the title of the company to its franchise, in payment for which the securities were issued in part. The commission then raised the point whether it should legalize the existing securities by approving refunding bonds, and in this respect the argument of the commission is consistent. But the decision then discusses the capitalization of franchises, quoting part of section 69 of the Public Service Commission law, which states: "The commission shall have no power to authorize the capitalization of any franchise to be a corporation or to authorize the capitalization of any franchise or the right to own, operate or enjoy any franchise whatsoever in excess of the amount (exclusive of any tax or annual charge) actually paid to the State or to any political subdivision thereof as a consideration for the grant of such franchise or right." Following its citation of this clause the commission adds: "The Long Acre company proposes to use $500,000 of the new bonds to replace the same amount issued to private parties for the franchise. This would be in effect a capitalization of the franchise, which is forbidden by law."

In the summary of the recommendations and in other paragraphs of the decision where this phase of the subject is discussed, it is made plain that the purpose of the commission was to assume that if the bonds outstanding were issued unlawfully their refunding would amount to capitalization of the franchise for which they were issued in part. The paragraph which we have quoted and the context convey the impression, however, that the question of approving the bonds was considered from each of two standpoints: (1) The illegality of issue of the bonds without approval of the State commission. (2) The capitalization of a franchise. The decision seems to permit the construction that the capitalization of the franchise was considered as an incidental reason for the action of the commission. To hold that if franchises had been capitalized in the past, the indebtedness represented by such capitalization could not be continued by refunding operations, would produce chaos. It is plain that any extreme interpretation of this nature would make the law retroactive. If an established company had issued bonds in conformity with the law 19 years ago and the securities were to mature next year, the commission could not refuse to approve an issue of refunding bonds, even if it suspected or knew that the maturing bonds had been issued in capitalization of a franchise as well as of tangible property. The outstanding bonds would be in the hands of innocent purchasers, and while an issue of refunding bonds might perpetuate an old capitalization of franchise rights, any other course than approval of such an issue would be confiscatory and therefore opposed to law and public policy. It is in this respect, as well as in others already noted, that the decision of the commission invites very careful consideration.

Electric Conveniences.

"This house is wired for electric conveniences" is a happily-coined phrase which is being used by a few central-station companies, and should be adopted by more. The word "conveniences" appears to fit the case more accurately than any of the other numerous expressions which have been used. It is both descriptive and suggestive to the layman, as many of the other expressions are not. For example, "electric service," which as a general term probably ranks next after "electric conveniences" in expressiveness, does not have to the lay mind the concrete suggestiveness of the word "conveniences." To say that a house is wired simply for electric lights is hopelessly out of date at this day.

A Case for the Board of Health.

It is high time that serious steps were taken to protect the eyes of the public against those who persist in misusing modern intense illuminants. The use of light for display and advertising purpose has now reached a point where the ordinary wayfarer is often exposed to serious annoyances if not temporary or permanent injury because the lamps are placed and installed without the slightest regard for public welfare. It is simply an assault on one's innocent neighbors to place a bare or inadequately shaded electric arc—or "gas arc" for that matter—close down over the sidewalk where it will shine squarely into the eyes of everyone who passes. The results are always uncomfortable and may extend to real injury, as many an oculist can bear witness. Now one may not produce needless and troublesome noises or evil smells in connection with his business without rendering himself liable for creating a nuisance and so coming into immediate collision with the Board of Health. Why, therefore, in lighting his premises should he be permitted to work injury to the eyes of those who share the street with him? Much of the difficulty comes from sheer ignorance and can be checked—as in fact it has been in numerous instances—by the tact of the electrical and gas supply companies. But a lighting company, electric or gas, however alert its illuminating engineer may be in detecting probable trouble, is not at liberty to refuse to supply a customer who has complied with the legal requirements merely because he has disposed his lamps badly. It can and does use moral suasion upon him, but there its power ends.

The installation of lights which trespass upon public territory without proper regard for public hygiene seems to us very clearly a case for Boards of Health to take up with a view to compelling reasonable care in the use of the extremely intense illuminants now common. Electric arcs, gas arcs, metallic filament incandescents, and the like are of far too great intrinsic brilliancy to be used without very considerable precautions. With respect to electric arcs the fact has long been recognized, and shades, too often not dense enough, are very commonly used. Gas arcs indoors are commonly shaded, but those in doorways and on the front of shops are too often bare. Even incandescent electric lamps and Welsbachs are capable of doing considerable mischief if thrust unshaded before the eyes, as they very often are. In the struggle for increased efficiency the hygienic conditions have steadily been growing worse, and while much missionary work in favor of proper methods has been done it has been only partially effective. In the first place, it is difficult to get people to realize that they can really see

better by a shaded light than by a bare one, and in addition a certain kind of fellow wants the brightest lights he can get, just to make the public take notice. Reform cannot be brought about in a minute, but it certainly should be possible to adopt some simple restrictions sufficient to abate the most serious troubles. For example, it would be easy enough to require all lamps abutting on public ways to be suitably shaded and, if of large power, hung above a specified minimum height. Very simple regulations easily enforced by the Board of Health would suffice for this, and one can safely say that the electric and gas companies could be counted upon to help in every possible way. As improvements in illuminants go on there will be increased necessity for action and the time to begin reform is right now. If intensive gas lamps and the quartz mercury arcs should come into extensive use there would be aggravation of the present difficulties, and since every increase of efficiency is likely to raise the intrinsic brilliancy of the source there is trouble brewing for the future. It is not at all necessary to start in on any drastic measures if the matter is taken in hand at once. The illuminating engineers can be trusted to carry on a campaign of education that will help matters wonderfully, and the only thing needed is sufficient activity on the part of Boards of Health to back up this campaign effectively. At present nobody really has power to act in any effective way, and so progress is slow. We are far from believing in paternalism, yet why should the ear and the nose be legally protected and the eye left unguarded?

ELECTRICAL ENGINEERING ANNUAL CONVENTIONS.

The sixteenth annual convention of the German Institute of Electrical Engineers—The Verband Deutscher Elektrotechniker—took place in Erfurt, June 11-14 last; while the twenty-fifth annual convention of the American Institute of Electrical Engineers took place at Atlantic City, June 29-July 2. Each of these important national associations meets annually in convention. The total membership of the Verband was stated to be 4303, having increased by 246, or 5.7 per cent, during the past year. The total membership of the American Institute was stated to be 5674, having increased by 1153, or 20 per cent during the past year. The American Institute is still behind the British Institution in strength of membership; but promises to be in the lead of all the national electrical engineering institutes shortly, at the present rate of growth. It seems very desirable that some co-ordination should exist between the institutions of electrical engineering in Europe and America. This might be accomplished, without expense, by mutual good will and agreement. A beginning might be made by an international agreement that all members in good standing of any one national society would be entitled to the privileges of free use of libraries and reading rooms of the others, on the occasion of visits. That is, it might be mutually agreed between the national institutes that a member, say of the German Verband, would be privileged to the free use of the library and reading rooms of the American Institute, in the case of his paying a visit to New York for a period of less than, say, half a year. There can be little doubt that, at the present time, if any member of one national body visited the headquarters of another national body, and offered his credentials, the facilities of the place would be courteously placed at his disposition. The point is, however, that by formally recognizing this privilege mutually, the various national bodies would make a simultaneous co-operative movement toward closer affiliation.

After a few years of co-operation to the extent of recognizing each other's members at headquarters, another step might be taken. This might be, for instance, that a member of one national institute, visiting another national institute, would be accorded the privilege of taking part in the discussions at which he might present himself. Unfortunately, such occasions would necessarily be infrequent, unless perhaps between the British and American institutes, owing to the difficulties of foreign languages. Nevertheless, a great point would be gained if the privilege of a visiting engineer's participation in a foreign national body's discussion could be mutually accorded. Ultimately, it is to be hoped that all national engineering societies may be internationally confederated to such a degree that their privileges, purposes, policies, and publications shall be co-operative and directed comprehensively. The funds and management of each national body should properly remain entirely in its own hands; but, at regular international conventions, mutual undertakings would be subscribed to, mutual plans fostered, and mutual publications announced. The mere accident of difference in mother tongue should not be allowed to annihilate the unity that inheres to applied science. What idea can be more incongruous and uncivilized than that of a number of large national institutes of electrical engineering each pursuing indefinitely a separate path, neglectful of the facts that their members are all engaged on substantially the same work, have practically identical ideals, and have, in the main, passed through the same training. Already botanists, zoologists, physicians and astronomers are better organized internationally than engineers.

THE DESIGN OF LARGE ALTERNATORS.

After many varieties and types of alternating-current generators developed in the past, we have settled down for the present to a practically uniform type of generator that, after considerable experience, is certainly serviceable and reliable; but which is unfortunately without a rival and therefore becomes monotonously uninteresting. The rotor is a steel ring supported concentrically upon the main shaft and carrying the radial laminated field poles. The stator is a surrounding laminated and internally toothed ring carrying the armature conductors and supported in an external cast-iron frame resembling a pair of semicircular bridge spans. This type of generator is now built in ratings up to 7500-kw, and its characteristics are well understood. It is so fully established as a standard type that one of the recent A. I. E. E. convention papers, abstracted elsewhere in this number, discusses a general equation, of a fractional order, for determining the maximum economy in an alternator of given rating, regulation, speed and heating, allowing certain prices for the purchase of copper, cast iron and steel.

The great advantages of this reigning type of alternator are the mechanical and electrical simplicity of the rotor, especially for high-speed service. The stresses that are imposed upon rotors during acceleration, or when accidental short-circuits occur, are so great, that mechanical simplicity of the rotating parts is essential for providing the necessary strength. The high-voltage conductors, moreover, do not rotate. Even under these conditions, designing engineers frequently have their hands full in meeting the requirements of special plants and special conditions.

Hydro-Electric Development in Tennessee.

In recent years the South has been forging ahead with respect to hydro-electric development, and promises before long to assume a position in this field only second to the Pacific Slope. The latest project is for the development of 49,000 kw at Hale's Bar, on the Tennessee River, about 15 miles distant from the city of Chattanooga. A dam and lock are being built at this locality to insure continuous navigable waters for river steamers from the Mississippi into Chattanooga, and the power development will be incidental to this waterway improvement, advantage being taken of the head thereby rendered available.

The Chattanooga & Tennessee River Power Company was incorporated early in the year 1905 to carry out the enterprise. The company was organized by Messrs. James and Guild, the directors being Mr. R. H. Williams, president, and Mr. George B. Lancaster, secretary, with Messrs. C. E. James, N. F. Brady, J. C. Brady and A. N. Brady as the leading spirits of the financial group. Mr. A. N. Brady has associated with him as technical advisers in this work Mr. John Bogart and Mr. Thomas E. Murray, of New York.

The company is now constructing the dam and placing vertical water wheels, which are to be built within the masonry and concrete foundations of the dam itself, the power house topping the dam. The installation provides for 14 4200-hp water wheels furnished by the S. Morgan Smith Company, of Pennsylvania. The company contracted last year for the first installation of 10 4200-hp units, they being now partly delivered or completed at the shops. All of this work has been carried out under the direction of Mr. John Bogart, consulting engineer of the company; the electrical work for the power house, transmission line and substation has been done by Mr. Thomas E. Murray, of New York, who, on behalf of the Chattanooga & Tennessee River Power Company, has recently awarded a contract to the General Electric Company for the electrical apparatus to be installed at the Hale's Bar power plant and at the step-down station in Chattanooga. The initial installation will consist of 10 3500-kw, 6600-volt, three-phase, 112½ r.p.m., 60-cycle vertical generators, to be driven by 10 4200-hp water wheels.

With two of the alternators are to be supplied two 100-kw, 250-volt, direct-current exciters mounted on the same shaft. In addition, the excitation is to be supplied by three 250-kw, 220-volt induction-motor generator sets. This equipment calls for five 300-kw, three-phase, step-down transformers used for the exciter motors, as well as for the power and lighting of the station.

The 6600-volt current will be stepped-up to 44,000 volts by three groups of transformers, each group to consist of three 3500-kw transformers and one reserve.

The transmission line will consist of two three-phase copper circuits carried on steel towers spaced about 600 ft. apart. There will be two long spans over the Tennessee River, one of 1600 ft. and one of 1300 ft. At the substation the current will be stepped down to 4000 volts, three-phase; the lighting will be at 2300 volts, single-phase, with an induction regulator in each circuit, and the power at 4000 volts, three-phase. The General Electric Company is to install all the station apparatus and wiring, including the switchboards for the main and substation.

The ultimate layout provides for the installation of four additional generating units, bringing the total power development up to 49,000 kw or approximately 60,000 electrical horse-power delivered in Chattanooga. The construction of the dam and power house, which is being carried out under the inspection of the United States government, is progressing very rapidly and it is expected that the first generator will be delivered at the power house on Oct. 15 next.

The Chattanooga & Tennessee River Power Company was incorporated in Tennessee in June, 1905, with a capital of $3,500,000 and authority to issue $3,500,000 50-year 5 per cent bonds. The company has received a 99-year franchise to supply light and power to Chattanooga and territory immediately surrounding the city.

Fire Alarm Telegraphs in New York.

After a prolonged investigation, the Commissioners of Accounts of New York have presented to Mayor McClellan their report on the Fire Department. No charges are brought against any officials, but many reforms are urged as necessary for the protection of the city. It is said that the telegraph alarm system is in such a condition that slight accidents might paralyze it to the peril of the city. It is also recommended that the city should buy out the private fire alarm concerns, particularly the Manhattan. The Commissioners desire also an installation of the 12-in. mains on the side streets of the city, and an extension of the high pressure system. Regarding the fire alarm telegraph plant the report says: "The whole fire alarm plant of Manhattan is of fundamentally faulty design, inadequate for the city's needs, in a dangerous state of advanced decay, and cannot now be repaired or rebuilt so as to afford even reasonable efficiency, the only solution being the immediate installation of a complete new system, including the relocation and construction of a properly safeguarded central station."

The Commissioners estimate that such a plant would cost $2,680,000, and it is suggested that the central station should be placed in the southern part of Central Park, or in Fifty-ninth Street, between Second and Tenth Avenues.

Sharp criticism is passed by the Commissioners on the arrangement by which the Manhattan Fire Alarm Company is permitted to use a patented device installed in the city's street fire alarm boxes, which transmits an alarm over the city's wires to Fire Headquarters. The other fire alarm companies of the city, the Automatic and the Consolidated Fire Alarm Companies and the American District Telegraph Company, have not this right to use city property. "By reason of the monopoly enjoyed by the Manhattan Company," say the Commissioners, "it is relieved from the principal or basic charge to which all other companies conducting similar business are subject, viz.: The installation or leasing of private underground telegraph wires running into Fire Headquarters and the establishment of a central station. Notwithstanding this, that company, during the 14 years of its active existence, has paid the city nothing in return for the use of public property, nor has it even reimbursed the city for the cost of telephone messages from headquarters and the time of city employees in advising the company to reset its contrivances."

Taking up the general system of water supply in Manhattan and the Bronx, it is suggested that all pipes across the city from the mains which run north and south should be made 12 in. in diameter. Some of them now are only 6 or even 4 in. in diameter. It is reckoned that the cost of the alteration with the installation of 6,000 new hydrants would amount to $3,540,000.

The electrically-operated high-pressure service, it is urged, should also be extended to cover the whole district south of Fourteenth Street. This would cost about $4,400,000. In Brooklyn a similar extension should take place so as to make the mains available along the entire water front. For this $1,000,000 would be required.

The Work of Instructors in Experimental Engineering.

The article below was prepared by Prof. V. Karapetoff originally for his assistants and associates in electrical work at Cornell University. The thoughts expressed are of general interest to young teachers in engineering, and some of the points will appeal to practicing engineers.

Each instructor must feel that the experiments under his charge are being conducted in the best possible way, that he knows the relating theory, and that he has made clear to himself the points that he is to teach to the students in each particular experiment. This requirement of maximum efficiency on the part of the instructors is not only fair from the point of

view of the college, but is good for the instructors themselves. It is an excellent moral training, a training of the character; in one's future activity the ability to get results even under adverse conditions, and with a sacrifice of time and effort, counts at least as much as mere knowledge of a few facts. In order that the ability to do one's best may become his second nature it must be practised all the time, in all the undertakings, and above all in one's direct duties. There is a good deal of valuable training in performing well and with gladness of heart the direct instructorship duties.

Supposing then that the instructor does full justice to his direct duties, what is the best way for him to spend the remainder of his time? The first advice is not to scatter his effort. Whatever he does let him do it with his full heart and deep interest. One man is able to carry one subject, another may carry four subjects, but let a deep, sincere feeling accompany all his work.

Now, speaking more specifically, an instructor in electrical engineering must be above all well posted in the elements of electricity and magnetism. By this is not meant a mere knowledge of facts and formulas, but an organic and a critical knowledge. By organic is meant such a knowledge which enables the man to see and to *feel* things, and apply and deduce them at any time. By critical knowledge is meant the co-ordination of various laws, a knowledge of their origin and the scope of applicability, an appreciation of the empirical part of a law and of its mere formal expression or derivation from another law. There is no use of talking of advanced work or of being a good teacher until this part of education is straightened out. This is essentially post-graduate work; an undergraduate cannot be expected to have either organic or critical knowledge, however desirable it may be.

An electrical engineering instructor ought to follow closely at least one electrical magazine, preferably two of different character. But to be able to do this a good knowledge of the theory and practice of electrical engineering is essential, because magazine articles are not written to teach the elements. The old saying that to him who has will be given more is fully applicable in this case. He who has a good general knowledge of standard electrical practice is enabled to follow the progress of the art in the magazines, learn more and keep up to date. The man who does not possess such knowledge gets more and more behind the times. One should acquire enough knowledge to be able to read magazine articles and A. I. E. E. *Transactions* with comparative ease.

The principal value of special investigations is the training in concentration and resourcefulness which they afford. Also, as a result of them man's self-reliance is increased. However, the study of the elements and of the actual engineering practice is of more importance to the majority of instructors than the advanced work.

Most students are interested in sciences and arts outside of electrical engineering. This is plausible, and they should do such work; the more distant it is from their specialty the better, for it affects then an entirely different faculty of mind, and does not tire out the engineering faculty. But the men should not pursue more than one course at a time, otherwise it would be scattering their effort and may lead to the dreaded disease "lack-of-timeness."

If an instructor would make up his mind to stay with a college, say, for four or five years, and not until the first better chance, the question of his personal work could be settled very nicely, and at the end of the above period he would leave as a well-educated, intelligent, competent man, fitted for a position involving considerable responsibility and knowledge. He could acquire during this period an excellent knowledge of the elements, as well as the common engineering practice and standards; he could perform an original investigation, and get a good deal of general culture.

But to be able to do this he must make up his mind in advance to stay, say, four years, and have his work laid out by competent men, in each branch. Otherwise, he is in a hurry to get all the wisdom in a short time, and does not get any.

Convention of the Society for the Promotion of Engineering Education.

The sixteenth annual meeting of the Society for the Promotion of Engineering Education was held in conjunction with the spring meeting of the American Society of Mechanical Engineers, in Detroit, Mich., from June 22 to June 27, 1908, and was one of the most successful and most largely attended conventions which the society has ever held. On account of its being the fifteenth anniversary of the founding of the society, as well as for the reason that the society was meeting with the Mechanical Engineers, the committee which had the program in charge introduced into it a number of entertainment features which made the week one of unusual interest and pleasure.

The first general session was held on Wednesday afternoon, June 24, with Vice-President William G. Raymond, Dean of the College of Engineering of the State University of Iowa, in the chair. The meeting was opened by an address of welcome from the Mayor of the City of Detroit, who, in a few well-chosen words, extended to the society the hospitality of the city he had the honor to represent, and congratulated the membership of the society on being among those who would be most influential in shaping the future destinies of America, inasmuch as they are, as teachers, the inspirers and molders of the engineers of the future, to whom the country must look, more than to any others, for the development of its natural resources and for the wise guidance and direction of all its industries.

Dean Mortimer E. Cooley, of the University of Michigan, responded, on behalf of the society, to the address of welcome given by the Mayor. Following this Prof. D. C. Jackson presented to the society the report of the joint committee on engineering education, created a year ago by a resolution inviting the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, the American Institute of Electrical Engineers, and the American Chemical Society, each to appoint two representatives to join with three representatives from the Society for the Promotion of Engineering Education in a thorough and comprehensive study of undergraduate and graduate courses of study leading to engineering; and the relation of these courses to the work of the engineering profession. The report which the committee presented this year was merely a report of progress, giving the names of the men who had been selected by the various societies, and a brief outline of the experience of each showing his eminent fitness for useful service on the committee, and also outlining the preliminary work which had thus far been done and the methods of approach by which the committee had determined to attack its problem.

Following the above report were two interesting papers on the teaching of English in Engineering Schools, the first by Prof. J. Martin Telleen, of the Case School of Applied Science, and the second on the results of an experiment in teaching freshmen English, by Dean William Kent, of Syracuse University. Professor Telleen described in a graphic way methods which he had employed in correlating instruction in English with the other subjects in the engineering course, thus making the subject both more interesting and more vital to young men whose central purpose was to train themselves to become efficient engineers. Professor Kent described an experiment which had been made during the past school year at Syracuse University to test a method for measuring the efficacy of English teaching, and at the same time to determine whether or not it was possible to improve the bad spelling of a considerable number of young men who entered the university without the ability to spell correctly. The English course in which this experiment was tried was one in which the whole time was devoted to teaching common English composition of the kind that an engineer would be called upon to use in his every-day practice; the subject matter of the student's composition was always kept within the range of his own personal

knowledge, and particular attention was paid to spelling, to punctuation, to paragraphing, to grammar and rhetoric, and to clearness in style of diction. The result of the experiment described by Professor Kent showed that it is possible, to a certain extent at least, to measure the efficacy of the instruction, and that marked improvement in the spelling of the students as a whole may be made. The results in percentages are given below:

	Percentage of Improvement.
Improvement in themes taken as a whole	20
Improvement in spelling	74
Improvement in punctuation and capitalization	29

The remainder of the afternoon was given to the following papers: "A Proposed Course in General Engineering," by Harwood Frost, secretary *Engineering News*, New York; "Present Curricula of the Mechanical Engineering Courses," by Prof. William T. Magruder, Ohio State University, and "The Correlation of Courses in Engineering Colleges," by Gardner C. Anthony, Dean of the Department of Engineering, Tufts College.

Wednesday evening was devoted to a joint session with the American Society of Mechanical Engineers, at which Prof. John A. Brashear, the scientist, astronomer, and manufacturer of lenses and astronomical instruments, of Alleghany, Pa., delivered an illustrated lecture on "The Contributions of Photography to Our Knowledge of Stellar Evolution." Professor Brashear, in a most charming and lucid way, told of the immensity of stellar distances and of the enormous velocities with which we are rushing through space as our world revolves about the sun and our whole universe travels through the heavens, and then described how the sensitive photographic plate, aided by the spectroscope, had opened up new fields of knowledge and made possible lines of investigation far beyond what otherwise would have been practicable.

On Thursday morning the members of the society enjoyed a trip as guests of the president and general manager of the Great Lakes & Engineering Works to the shipyard at Ecorse, to witness the launching of the 10,500-ton steamer *William B. Meachum*. This launching was of special interest, as it was the first time that many of the members, especially those from the East, had ever witnessed the "sidewise" launching of a vessel, as is the custom everywhere on the Great Lakes, as distinct from the usual end-on method which is customary on the East coast.

The interest in the session on Thursday afternoon centered in the address of President Charles S. Howe, of the Case School of Applied Science. The title of his address was "The Function of the Engineer in the Conservation of the Natural Resources of the Country." President Howe, as representative of the society, had been invited to attend the conference at the White House with the Governors of each of the States, the Members of the Cabinet, the Judges of the Supreme Court, and representatives of all the other great engineering societies, which the President of the United States called together on May 13, 14 and 15; and in his address President Howe presented to the society in a most forceful way the serious problem which our country must face in a short time if the waste of our formerly abundant natural resources is permitted to continue. He described the rapidity with which all the forests are being depleted and the fuel supply exhausted, the rate at which the available natural store of iron ore is being consumed, and the rapid exhaustion of the soil, and in conclusion stated his conviction that the problem of the conservation of the natural resources is one which the engineers of the country must solve, and that the colleges of engineering must also have a share in the work. They are training the engineers of the future, and from now on he urged that they train them with this problem in view. The colleges must give not only the principles of engineering practice, he contended, but they must also show how the work of the engineer can be carried on with a view of transmitting to posterity the natural resources so far as possible in an unimpaired condition.

At the conclusion of the president's address a resolution was unanimously passed authorizing the appointment of a committee to recommend ways and means of carrying out the suggestions in the president's address, that the colleges of engineering help in the solution of the problem of the wise conservation of natural resources.

The other papers on Thursday afternoon were as follows: "Adapting Means to the End in Technical Education," by Arthur L. Rice, managing editor of *Practical Engineer*, Chicago, in which he made a plea for a clearer distinction between the training for the professional engineer who is to be a leader and the engineering subordinate who must have a considerable degree of technical training, but who, after all, perhaps, belongs nearer to the high-grade, skilled and intelligent craftsman. In many schools, Mr. Rice felt, there is a tendency to compromise between the two purposes indicated, which is unfortunate.

"The Place of Foreign Languages in the Curriculum of the School of Engineering," was the title of a paper by Prof. Arthur L. Wright, Case School of Applied Science, in which the author made a strong plea for the necessity for a mastery of a foreign language from the utilitarian or practical point of view.

"Second Degrees for Graduates of Engineering Courses," was read by Prof. William F. M. Goss, Dean of the College of Engineering, University of Illinois.

"Scholasticisms in Engineering Education," was presented by Prof. John Price Jackson, Dean of the School of Engineering, Pennsylvania State College.

"Concentration of College Work on a Smaller Number of Subjects," was read by Milan R. Bump, secretary of the Doherty Operating Company, New York City.

On Thursday evening the members of the society were invited as guests of the American Society of Mechanical Engineers to its annual reception. This was the distinctively social feature of the convention, and was largely attended by the ladies, who came as guests of the members. The reception was held in the main dining hall on the second floor of the Hotel Cadillac.

The first business of the session on Friday morning was the presentation of the report of the secretary, at the request of the council, of the amendments to the constitution, which were unanimously adopted, the more important changes being the increase of the annual dues from $3 to $3.50, the creation of a publication committee, the defining more definitely of the duties and powers of the executive committee of the society, and the methods of taking and counting letter ballots.

The secretary reported the affairs of the society to be in a most flourishing condition, stating that there never had been previously a period in its history when the interest in the work of the society was so active or so general, or when the expressions of confidence in its usefulness had been so strong. He reported an increase in membership during the year of 182 names and only four resignations; an increase 70 per cent greater than in any previous year. He also reported the registration of 104 members at the meeting—a registration 37 per cent greater than at any previous meeting.

For the committee on technical books for libraries, Prof. Arthur H. Ford presented a report of progress, and then followed three papers on laboratory equipments and methods of laboratory instruction. These were as follows:

"Hydraulic Laboratories, their Equipment, Method of Conducting Work, their Efficiency as a Factor in Engineering Education, Methods of Teaching Hydraulics," by Prof. D. W. Mead, College of Mechanics and Engineering, University of Wisconsin. "Electrical Laboratory Efficiency," by S. Sumner Edmands, head instructor in applied electricity, Pratt Institute, and "Cement Laboratory Practice," by Prof. Ira O. Baker, University of Illinois.

The last two papers of the morning were: "Entropy, a Simple Method of Presentation," by Prof. W. D. Ennis, Polytechnic Institute of Brooklyn, and "How Far Is Pure Thermodynamics of Value in Preparing Students for Handling Me-

chanical Engineering or Heating Problems," by Prof. Arthur J. Wood, Pennsylvania State College.

The members, guests and ladies were invited by the Detroit local committee to an afternoon and evening sail on the Detroit River. They left on the steamboat *Britannia* from the Detroit, Belle Isle & Windsor Ferry dock, at the foot of Woodward Avenue, sailed around Belle Isle, thence down the river to Amherstburg, and to the head of Lake Erie, and returned by way of Bois Blanc Island, where supper was served.

The first business of the session on Saturday morning was the reading of the report of the nominating committee and the election of officers of the society for the ensuing year. The following officers were elected: President, Frederick E. Turneaure, University of Wisconsin; first vice-president, Mortimer E. Cooley, University of Michigan; second vice-president, Olin H. Landreth, Union University; secretary, Arthur L. Williston, Pratt Institute; treasurer, William O. Wiley, John Wiley & Sons.

Following the election of officers the report of the committee on industrial education was read by Prof. Arthur L. Williston, director of the Department of Science and Technology, Pratt Institute, as secretary of the committee. The report was a statistical one, and aimed to show as clearly as possible what is being done at the present time in vacational training of trade or mechanical character for young men in day courses in the United States. The schools giving such instructions were divided so far as possible into groups, a short description being given of each group.

Another paper of interest was "Two Years of the Co-operative Engineering Courses, University of Cincinnati," by Prof. Herman Schneider, University of Cincinnati, an abstract of which was given in our issue for July 11.

Prof. Franklin De R. Furman, of Stevens Institute of Technology, presented a very interesting paper on "The Careers of Graduates in Mechanical Engineering," showing in tables and in plotted curves the types of positions which every one of the graduates of his institution had held at the end of each five years' period since graduation.

Another paper which attracted a good deal of attention and brought out an interesting discussion, was that by Prof. V. Karapetoff, of Cornell University, entitled, "The Concentric Method of Education in Engineering." The most radical feature of his recommendation is the giving in every course of a general review of the subject preceding the theory; the descriptive courses are in the first year, the mathematical and analytical ones in the later years of the course, thus practically inverting the order established in almost every engineering school in the United States. Another unusual feature which was recommended is the teaching of auxiliary subjects in connection with any engineering course, only in the proportion in which they are needed for the understanding of the engineering subjects and the teaching of them in connection with those subjects.

The other papers which were presented were, "The Relation Between Engineering Education and Industrial Education," by Prof. Charles R. Richards; "A Summer Course in Surveying," by Prof. Charles Derleth, Jr., University of California; "The Co-ordination of Work in Drawing Rooms, Shops and Laboratories, and the Real Function of Shop Instruction for Engineering Students," by Prof. Dexter L. Kimball, Cornell University; "Requisite Qualifications of an Engineering College Instructor," by Oliver B. Zimmerman, Charles City, Ia.; "Should the Engineer Be Required to Hold License?" by Prof. Walter H. Drane, Dean of the School of Engineering, University of Mississippi; "The Use, Abuse and Care of Lantern Slides," by Prof. H. H. Norris, Cornell University; "Shall We Try to Develop General Culture by Teaching Engineering Subjects in a Broad and Comprehensive Way, or Shall We Introduce Unrelated Subjects Because of their Supposed Culture Value?" by Prof. E. Brydone, University of Manitoba. On account of the short time available a number of these papers were read by title only.

Some Notes from Europe.

By Dr. Louis Bell.

Munich is a city of power transmission work. There is a big plant on the Isar about 30 km away and the currents come into the suburbs on an overhead line at 50,000 volts and then step down to 5000 volts for the distribution underground. They use a much smaller insulator than we should for such a pressure, but it has a very deep bottom petticoat that seems to save the game. I wonder what our English friends think about 50,000 volts overhead in conservative Germany and coming into the outskirts of a city of half a million at that!

One of the most interesting places I have visited is the municipal central station in Dresden. The number of municipal stations over here is fairly shocking to the American, especially if he happens to be a member of the N. E. L. A. But for comfort let it be written down that the prices for current are not paternalistic in the least, being generally higher than in places of similar size at home, especially in virtue of lower discounts here. But to recur to the Dresden station. It is a big, spacious affair, with a ground plan very like the usual one at home—long dynamo room with the generating sets and parallel boiler house with short steam piping. It is built of brick with a particularly neat and clean tiled floor, a 30-ton traveling crane, and a switchboard gallery at one end. In 1895, when it was built, it certainly represented advanced ideas in many ways. It is a little unusual in being straight single-phase throughout with 2200-volt generators. The distribution is through concentric cables laid in cement ducts. There are eight generating sets—alternators with revolving fields direct coupled to tandem-compound condensing engines. The condensation is by water drawn from a little branch of the Elbe, and in case of low water or anything going wrong, there is a pair of cooling towers worked by motor pumps.

The boiler room is particularly interesting. The boilers are two-story affairs in brick settings, except for a couple of water-tube boilers used for forcing the load in winter. The lower story is a simple flue boiler, and the gases pass through this to the rear and then up and forward through a multipolar boiler to the stack, the horizontal return tubular idea considerably modified. The grates are very peculiar, extending downward at an angle of perhaps 60 deg. into the stoke hole below, but fed by gravity alone from the boiler room floor. The coal is brought on little trucks on rails and dumped into the hoppers and gravity does the rest. Below a fireman merely keeps the grates clear. The tall chimney gives a powerful draft and the fires seem to work very smoothly. The *raison dêtre* of this curious arrangement is that the fuel is the brown Bohemian coal, resembling lignite. It carries about 30 per cent of moisture with 8 per cent of ash and evaporates hardly more than half the water equivalent of a fair steam coal. It requires peculiar conditions for effective combustion, especially as there are stringent requirements against smoke. The station is exceptionally good in the matter of smokeless combustion—extraordinarily good considering the fuel. For banking the fires coal briquettes, 2 in. or 3 in. cube, are used, as the brown coal is not fit for banking. Briquettes are a regular thing over here; the only ones I have seen at home were some samples which the owner grimly told me cost him $20,000 apiece, in money blown in on fruitless experiments.

The station switchboard is an interesting one, remarkably simple, and the machines are provided with automatic regulators working on the exciters, highly sensitive and very simple. At times of rapidly varying load auxiliary hand regulation is used merely to keep things within range of the automatics. The station carries about 2000 hp in single-phase motors, mostly below 5 hp, but a few larger.

To recur to the generators. There are two 1000-kw sets, two 750-kw and four 500-kw. The latter, the original installation, are of old Helios machines, the larger ones Lahmeyer. The exciters are direct connected multipolar, the speed of the sets being 85 r.p.m. for the larger ones and 95 r.p.m. for the smaller.

Each revolving field has an internal gear and a very compact little donkey engine is mounted on each bedplate with pinion ready to mesh and turn over the big engines if it is desired to do so. Alongside this station is the city electric railway station, 2000 kw in five direct-connected units. Like the lighting station, this is kept in admirable shape. One of the big Schuckert generators that was standing idle struck me by reason of the beautiful condition of the commutator; and I was informed that it had not been turned down since it was installed seven years ago. They use composite brushes of copper and carbon, but the secret was in the admirable commutator design, since the same brushes on their machines of other make did not save the day and they had no end of trouble.

One of the Munich electricity substations is located out by the colossal statue of Bavaria in a park with beautiful surroundings, an extremely neat and clean building with a complete equipment for receiving, like the other substations, three-phase current at 5000 volts from the Isar transmission system and converting it into direct current for the low-tension network.

It contains two Siemens motor-generator sets each of about 400 kw and running at 500 r.p.m. The generators are self-contained, three-wire machines, each with two commutators side by side on the shaft. These machines feed the incandescents either directly or through big Tudor accumulators which form an essential part of all the Munich substations. The e.m.f. of the low-tension network is 2 x 120 volts. There is also a 600-kw, 650-volt motor-generator set used for the arc lighting or railway service, if required. The arcs are in series of 13—the largest series I have noted over here yet—so that they can be worked from the railway machines. The 600-kw set runs at 250 r.p.m. at the standard Continental frequency of 50 cycles. The lighting at the substations is all sorts—ordinary arcs, flame arcs, incandescents and Welsbachs—nothing at all sensational about it.

But the city electricity works would do your heart good to see; in a beautiful situation by the river, from which they get a little water power (about 150 hp), with well-kept grounds and a spacious and beautifully equipped laboratory. Even the chimney is an admirable bit of decorative work. The station is now chiefly a transforming station taking power from the Isar plant, but keeps its steam plant in commission and generates perhaps 10 per cent of the total yearly output of energy.

From Munich it was on to Vienna by the Orient express, a fairly comfortable train, but not in the class with our *de luxe* trains at home. There is no way of making a light car really comfortable at anything but very moderate speeds. There is a nasty lateral vibration which cannot be got rid of, and which must produce a decided effect on the train resistance. In fact, Continental train formulas do not work with us, as is well known.

From an electrical standpoint Vienna is interesting, but without striking novelties. The big city station has been often described. Very many tungsten lamps are used, mostly Kreminisky, as far as I could judge, though I do not doubt one could find a considerable variety. But here, as elsewhere, the metallic-filament lamps are very badly arranged in general. They are commonly merely stuck into the socket instead of a carbon lamp and allowed to burn fully exposed. The result from an illuminating standpoint is something awful. My right eye is quite done up from an encounter with the wretched things while sitting at dinner. As I have before remarked, interior lighting as a whole over here is badly done and especially in the case of the new lamps is their utter disregard of the first principles of eye hygiene. There are some frosted lamps, but diffusing shades seem to be almost unknown in interior work, although common enough on the street arcs. I fancy the reason is that the customer having to supply his own lamps simply goes ahead and sticks them in, and the supply station has nothing to say about it. Our home practice of free lamps has proved a blessing. But I think the very worst example of illumination I have ever seen is that in some of the great outdoor restaurants in the Prater; innumerable Welsbachs in clear globes on very short posts stuck up everywhere so that there is no escape. It is bright, almost as day, but the Vienna oculists must reap a harvest. There are few flame arcs to be seen except for display purposes, some Nernst lamps, and I failed to discover any quartz mercury lamps, which are beginning to come into use for display lighting in Germany. In short, Vienna in such matters is rather conservative, just as it is in some other things—automobiles, for example, are scarcer than anywhere I have been, and there is no taximeter cab system such as one finds elsewhere. But things are moving; the use of electric lights has almost doubled in the past two years and there are now something like 2,400,000 incandescents in use, a number rapidly increasing, too. The heat in Vienna has been terrific and I note with interest that they give one the same old gag in the papers about its being the hottest spell of weather in June for 80 years.

I am writing this in Budapest, where I arrived in the middle of a boiling hot afternoon. As to impressions here, I haven't had time to form many, but I note that the American invasion has swept down here, advertising typewriters on the fences in the suburbs, and I saw on a freight car some American farming machinery. But there is no such overrunning the place with American products as in many parts of Germany. The first electrical thing that strikes the eye in the city is the absence of trolley wires—this city being one of early scenes of slot-conduit working. The bow trolley used outside is tied down upon reaching the conduit territory. Trailers are in general use here as is quite usual in other cities outside our own country. The cars impress one as being like most Continental cars, light and small. To-morrow I shall start after things electrical, if it doesn't turn out to be another holiday. There is no side-stepping Continental holidays—they follow one up like sleuth hounds. One nabbed me in Munich, and the morning after I reached Vienna I was wakened by the ringing of bells and the sound of many voices chanting, and looked out to see, almost under my window, the Cardinal Archbishop of Vienna before an outdoor shrine in front of the Church of the Capucins, in the crypt of which rest at last the luckless Hapsburgs.

Dry Batteries for Railway Block Signal Service.

In a paper read before the recent convention at Montreal of the Association of Railway Telegraph Superintendents, Mr. U. J. Fry, of the Chicago, Milwaukee & St. Paul Railway, reported that 32 cells of dry battery had lasted three years in block-wire service on a section of his road. The total expense was $5.12 as against $102 first cost and maintenance for three years of 32 cells of gravity battery.

As applied to service on a railway operating 2000 miles of block-signal service under the same conditions, he estimated the first cost and maintenance of 4000 cells of gravity battery necessary, for three years, at $14,000, while double the number of dry cells (8000) will cost $1,280, a difference of $12,720, or $4,360 per year or $2.18 per mile of road per year.

He referred to a temporary installation of dry batteries on the Coast Extension Railway. The circuit was short and a sufficient number of cells was connected up to operate a wire 100 or 150 miles in length and resistance added to cut the available current output down to 50 milliamperes. As the circuit was extended resistance was cut out, thus maintaining the current constant at 50 milliamperes. Low expense, convenience and portability were advantages pointed out for such an equipment.

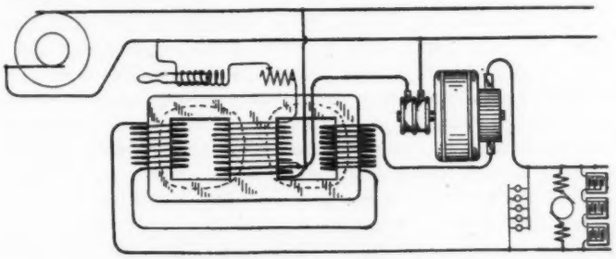
New Metallic Glower.

A patent was granted June 30 to Orlando M. Thowless, of Newark, N. J., on an incandescent lamp glower of a composite nature and having tantalum or a similar metal as one of its components. The glower consists of a tube of a highly refactory metal or metal alloy, in which is packed a refractory metal such as thoria, in the state of a fine powder. The cylinder when properly packed is then treated as though made of a

solid metal and is drawn out to a diameter suitable for use as an incandescent glower. The material of the cylinder may be pure tantalum or an alloy of a pure metal of the vanadium or platinum group, or an alloy of platinum with osmium, iridium, rhodium or ruthenium. The filling may be powdered thoria, magnesia, ceria, zirconia, yttria, terbia or other refractory oxide. One of the general claims of the patent is on an improved glower for electrical incandescent lamps, composed of a ductile refractory metallic tube containing a compact pliable core of refractory non-conductive metallic oxide. In other claims the filling is described as a refractory non-conductive substance.

Voltage Regulator for Alternating-Current Converters.

In a patent issued June 23 to Prof. F. B. Crocker a description is given of a device for causing to be supplied to an alternating-current rectifier or a synchronous converter an e.m.f. whose value varies with the direct-current load. The delivered alternating e.m.f. differs from the supplied e.m.f. by a certain amount, which latter amount is caused to vary automatically both in value and in time-phase with the direct current. The variable e.m.f. introduced into the supply current is obtained from the secondary coil of a transformer whose primary is connected across the generator leads, and the reluctance of whose core is caused to



CROCKER VOLTAGE REGULATOR.

vary with the direct current; when the reluctance is low the current in the primary coil produces a large value of flux in the core and hence the e.m.f. generated in the secondary coil is large. This e.m.f. is arranged to oppose the generator e.m.f. when direct current has zero value. When direct current exists it is passed through coils arranged to magnetically saturate the core of the transformer, thereby increasing the reluctance of its core. With increase in reluctance the primary current, although slightly increased in value and changed in time-phase, is unable to maintain the former value of flux, and the secondary e.m.f. is decreased. Hence the e.m.f. delivered to the converter increases with increase of load. The arrangement proposed is shown in the accompanying illustration.

Variable-Speed Polyphase Induction Motors.

Two patents issued May 24 and assigned to the General Electric Company relate to the method of varying the speed of a polyphase induction motor by changing the effective number of poles. The primary is provided with two separate windings, having different numbers of poles, so arranged as to be non-inductive with respect to each other. These two windings

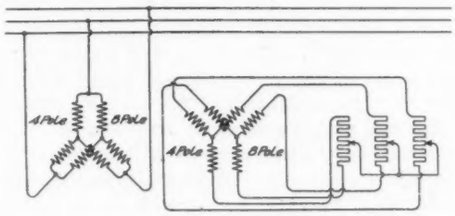


FIG. 1.—ALEXANDERSON INDUCTION MOTOR.

are used simultaneously, the rotor being given a torque, which is the resultant of the two torques produced by the two windings. Means are employed for varying the relative and absolute values of the two component torques so as to obtain the required resultant torque at each value of speed.

A method of obtaining the variations in the relative torques invented by Mr. E. F. Alexanderson is shown in Fig. 1. The secondary is provided with two coil windings having the same numbers of poles as the two primary windings. The individual torques are varied by changing the resistances included in the separate secondary circuits.

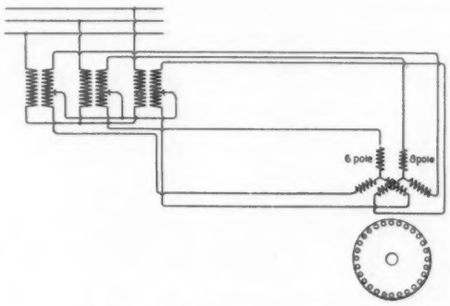


FIG. 2.—PAULY INDUCTION MOTOR.

Fig. 2 indicates the arrangement invented by Mr. K. A. Pauly. The motor has a short-circuited secondary of the squirrel-cage type, the variation in the two compound torques being obtained by modifying the relative and absolute electromotive forces impressed on the two primary windings.

CURRENT NEWS AND NOTES.

COAL IN PENNSYLVANIA.—According to Mr. E. W. Parker, the well-known expert connected with the United States Geological Survey, there is now left in Pennsylvania only enough anthracite coal to last 100 years at the present rate of consumption. In like manner, he estimates the supply of bituminous coal in the State at about 400 years.

TELEPHONY IN PARIS.—De Castellane, in recent correspondence in a New York newspaper, states that a telephone subscriber in Paris, who thought that he had been treated with discourtesy by the exchange operators, went to the government office to complain. On making his statement, which he did apparently with some indignation, he was seized by five male clerks and thrown out, his gray frock coat being torn in the melee, while the "hello girls" stood at the exchange windows and jeered. As names are given in the description of the incident, it is difficult to question the authenticity of the story; but what a curious light it throws on telephony in France!

AMERICAN STREET RAILWAYS.—The fifteenth annual volume of "American Street Railway Investments," familiarly known as the "Red Book," has just been issued for 1908 by the McGraw Publishing Company. This handsome quarto is larger than ever, having reached a total contents of over 500 pages. As usual, a large number of maps are presented and the statistical and general information is prefaced by data as to changes and developments in some of the leading cities. Five financial groups are given of companies, the classification being by earnings. Of these companies, 78 have earnings of over $1,000,000, ranging upward to the Interborough, of New York City, with $23,000,000; the Brooklyn Rapid Transit with $19,000,000; the Philadelphia Company, of Pittsburg; the New York City Railway and the Philadelphia Rapid Transit Company, each with over $18,000,000. The "Red Book" is a valuable financial and technical record of the street-railway industry.

MICA PRODUCTION.—The United States Geological Survey reports the production in this country during 1907 of mica to the value of $392,111 in 11 States. The imported mica was worth $925,259. The large and increasing consumption of mica is attributed by the bureau to its greater use in electrical work.

FARADAY SOCIETY ELECTION.—At the annual general meeting of the Faraday Society, held in London on June 23, Sir Oliver Lodge was elected president and the following vice-presidents were chosen: G. T. Beilby, R. A. Hadfield, Prof. W. Hittorf, Prof. A. K. Huntington, Lord Rayleigh, Prof. A. Schuster and Prof. J. J. Thomson.

JAPANESE ELECTRIC ROAD.—U. S. Consul-General Henry B. Miller, of Yokohama, Japan, reports that the department of communications has granted a charter to the Muhashi Electric Railway Company to build a line from Tengen-ji Bridge, in the Iliro-o suburb of Tokio, direct to Hiranuma, with branch lines to Chofu-mura and Kemada. It is stated that the line will be built in accordance with the private railway law, and that consequently it will be planned on a much larger system than that followed in the case of ordinary electric railways.

JAPANESE DUTIES.—In our issue of April 25 appeared an interesting article by M. Kawara on the Japanese manufacture and importation of electrical machinery. A number of statistics were given as to quantities and values of apparatus. In the course of the article, Mr. Kawara spoke of the erection of factories in Japan by Americans as a very wise measure, stating that the imperial tariff duty on finished machines is 25 per cent ad valorem. Messrs. E. H. Hunter & Company, of Japan, have called our attention to the Japanese tariff books which show the actual duty in question to be 15 per cent. The argument advanced by Mr. Kawara probably remains unaffected.

MARCONI'S DUPLEX WIRELESS AND OTHER EXPERIMENTS.—In a recent interview with a representative of a London daily newspaper, Mr. William Marconi stated that he has lately been experimenting with duplex wireless telegraphy. The experiments, he said, were quite successful over a distance of three or four miles. He anticipates equal success over the Atlantic Ocean before long. The present speed of transmission across the Atlantic, in one direction, is 24 words per minute. He also referred to another of his recent experiments. Its object is to enable a ship approaching the shore, or another ship in a fog, to determine exactly the position of the wireless station on shore, or the course of the other ship.

A STUDY OF EUROPEAN TRACTION.—William McCarroll, member of the Public Service Commission of the First District of New York, accompanied by Chief Engineer Henry B. Seaman, has returned from Europe where he has been studying the transportation problems of London, Paris and Berlin. Mr. McCarroll says that the problems in these cities are entirely different from those in New York, as the direction of traffic is diversified and there is no congestion at rush hours. "As the Underground roads in London," said Mr. McCarroll, "have only two tracks, there is no express service, and in that respect the New York subway is far ahead of the London tubes. The subway cars in London are equipped with three doors, one at each end and one in the center, with the result that passengers are discharged quickly." In Paris, what was most striking was the thoroughness with which all work was done, no disturbance of traffic or damage to abutting property being possible. In Berlin, Mr. McCarroll said, the subways were yet undeveloped but the elevated lines were excellent. The structures are made an ornament to the street by artistic decoration, and the roadbed is constructed on a solid floor which does away with the noise almost entirely.

ANOTHER ELECTRIC GUN.—It is announced from Paris that a French army officer is submitting to test a new rapid-fire gun worked by electricity capable of firing 1200 shots a minute without the use of powder or explosives of any sort. It is the invention of a young French engineer, M. Alfred Pouteaux, a native of Dijon. The new gun has a metallic tube open at both ends; that is to say, it has no breechpiece. This tube is about 4½ ft. long. Its diameter is 2½ in. The projectiles are carried from the ammunition reservoir with tremendous rapidity by electricity and are hurled by the same force. There is a continual "jet" of projectiles as long as the current is on. A remarkable feature of the "cartridges" is that they are all bullet, there being no brass case or powder chamber. As there is no combustion there is no danger of explosion. Moreover, the piece can be constructed much more economically than an ordinary cannon, as no great resistance to heat or pressure is necessary. The principles of the new gun are being kept secret. All that the inventor will say is that he utilizes polyphase currents of high frequency.

ENGLISH PATENT LAW.—Mr. Charles H. Duell, former Commissioner of Patents and member of the law firm of Duell, Warfield & Duell, New York, has just returned from England, where for two months he has been working for some mitigation of the new patent law. August 28 is the time limit at which patents more than four years old on articles mainly or exclusively manufactured outside the United Kingdom may be revoked. Mr. Duell said the measure was popular with workingmen, who expect an increased demand for labor as a result, and with the growing number of protectionists. In five years, he predicted, England would cease to be a free trade country. The new law was aimed primarily against German manufacturers of aniline dyes and chemicals. At least one of the largest of these manufacturers has already established a plant in England. In America those most affected by it are the manufacturers of typewriters, cash registers and kindred apparatus, as their sales in England, while appreciable, are not sufficient to warrant the founding of independent factories and the training of skilled labor. The Gillette Safety Razor Company and the United Shoe Machinery Company already have started plants, in compliance with the new law, on British soil.

NEW YORK WATER PRIVILEGES.—An interesting statement was made last week by Deputy Attorney-General Decker, of New York State, as to the suit of the Fulton Heat, Light & Power Company, of Fulton, N. Y., which asks $3,200,000 damages for the alleged appropriation by the State for the barge canal of private property in the bed and waters of the Oswego River. "The claim of the Fulton Company, now on trial," says Mr. Decker, "arises out of the new canal improvement. The claimant is only one of some sixteen users of water power at Fulton, and there are scores of water power users at other points affected in the same way who may make similar claims. It is doubtful if the interests of the State were ever more boldly challenged. The State claims that the Oswego River was by nature and immemorial usage a public highway before the river was canalized; that its bed and waters were never bartered away, or, if they were, that the grant was subject to navigation uses. The State also claims that if this river ever became private property it was reappropriated by the State when it was canalized in 1826. If the State's position is unsound, it will probably result in preventing the completion of the present canal enlargement, as well as the undertaking of any State improvement of navigation hereafter, because of the increasing value of water power, with wood gone and coal going. This case is the first in a very long time which has arisen directly against the State and wherein this question has been involved. It will determine whether the water power of our larger rivers and of the canals is held as an irrevocable monopoly in private hands."

Hydro-Electric Generating Station at Caffaro, Italy.

THE hydro-electric station at Caffaro, Italy, was built primarily to supply electrical energy to a large electrolytic plant for the manufacture of caustic soda and also to supply the cities of Brescia, Manerbio, Cremona and Ponte Viggo with electricity. The mountain river Caffaro has its source in the Adamello range situated on the frontier between Lombardy and Austria. The river is fed chiefly by small Alpine streams and after a course of about 18 miles empties into the River Chiese, a tributary of the River Po. The normal flow of the river is 141 cu. ft. per second and for many years past the river has supplied motive power to saw mills and local industries. The lower portion of the river has a fall of about 820 ft. in a distance of three miles so that while the amount of water is comparatively small taken into consideration with the fall, about 13,000 hp is theoretically available. There is another fall higher up the river which when regulated will yield about 6500 hp so that the total power available from this otherwise insignificant stream is approximately 20,000 hp.

In the neighborhood of Bagolino, where the river passes through a ravine, a barrage has been constructed. Back of this barrage is a natural basin so that the site was well selected. The barrage is 69 ft. long and 16 ft. thick. The crest slants slightly toward the center so that there is a direct overflow in times of flood. To one side of the barrage are four heads; the internal diameters of which are 1.3 m x 1.8 m (51 ft. x 71 ft.), in each of which the flow is about 353 cu. ft. per second. After passing through these, the water collects in a canal 19 ft. 8 in. wide which is provided with screens and spillways and which gradually narrows down to the normal section of the conduit to the forebay.

The conduit is partly rectangular and partly elliptical in section, according as it runs in the open or is placed underground. The grade of the conduit is very small and along its length seven spillways are provided. The first is placed close to the four heads previously mentioned and allows an overflow 230 ft. long. The forebay is built at Monsuello at a height of about 820 ft. above the generating station. From the forebay two penstocks 3 ft. 3 in. in diameter descend. The penstocks consist of lap-riveted pipes except for the last 230 ft. of the line where the hydrostatic pressure is about 330 lb. per square inch. The pipes for this distance are made of lap-welded steel plates.

The penstocks vary in thickness from 3/16 to 11/16 in. Two long expansion joints and two manholes are provided in each penstock, the usual sluice valve being also provided. Both pipes are carried on cast iron saddles imbedded in a stone foundation wall. A masonry discharge conduit running partly underground and provided at intervals with small shafts to reduce the velocity of the water is built at the side of the penstocks.

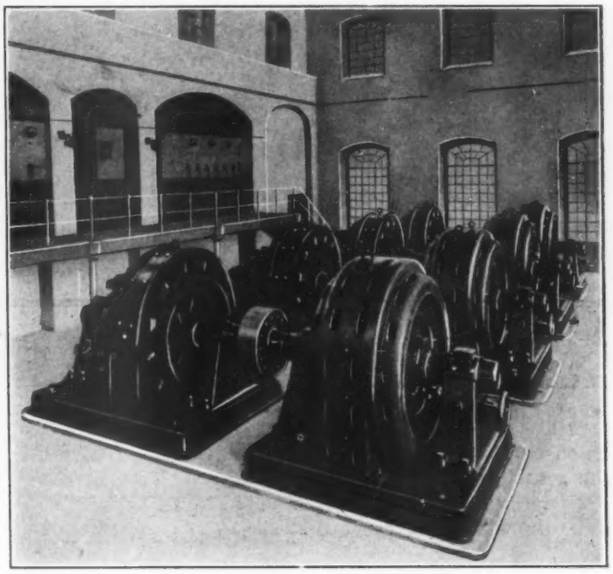


FIG. 2.—BRESCIA CONVERTER STATION.

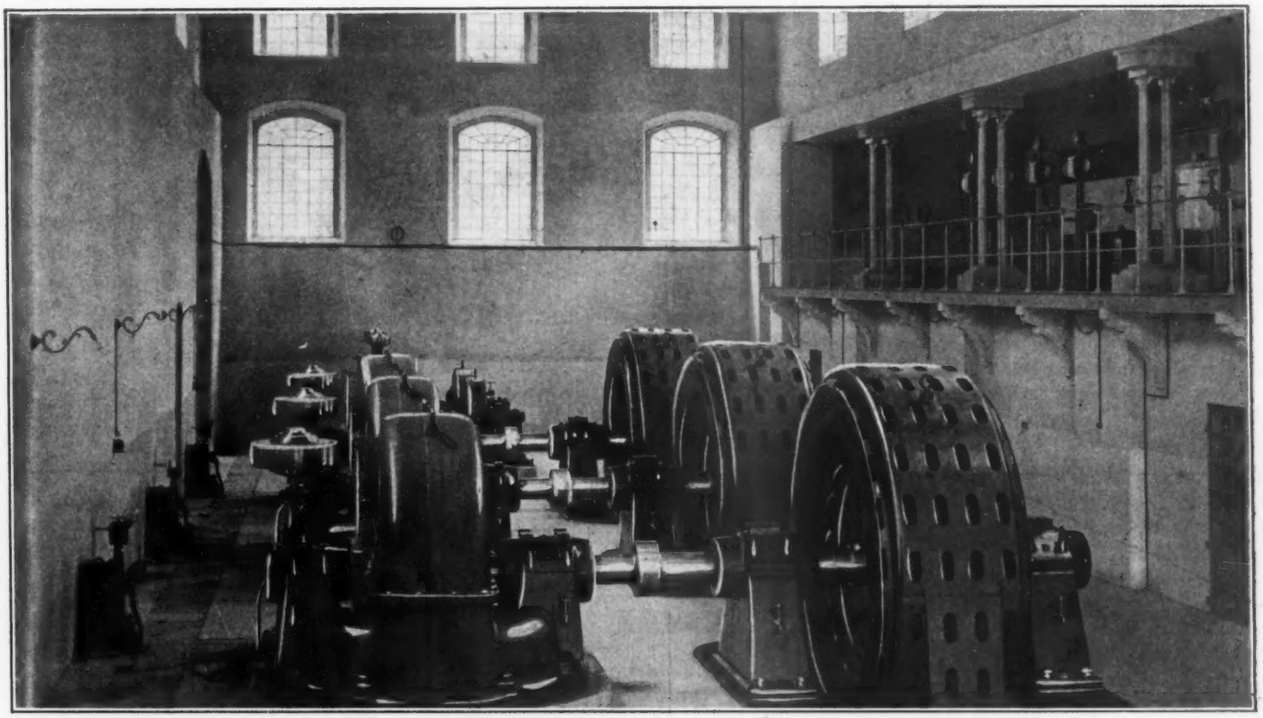


FIG. 1.—INTERIOR VIEW OF STATION.

An interior view of the generating station is shown in Fig. 1. The equipment consists of three Pelton-type water wheels built by Messrs. Riva, Monneret & Company, of Milan. The wheels are designed for the flow of 1000 liters of water per second under an effective head of 808 ft., thus developing about 2500 hp at a speed of 315 r.p.m. The wheels are fitted with

Hartung hydraulic governors. Two smaller turbines rated at 160 hp are direct-connected to exciter dynamos, each of which has an output sufficient to supply the excitation for four alternators equal in size to those installed. A third turbo-generator unit, shown in the background of Fig. 3, supplies the energy for station lamps and local service. The unit works in conjunction with a storage battery.

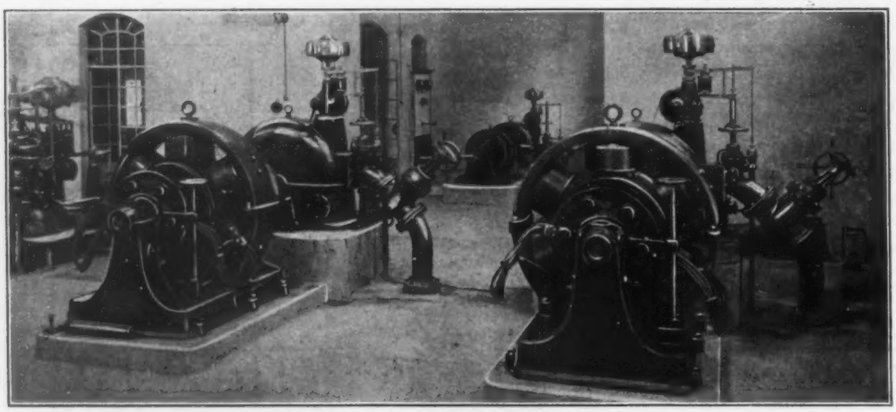


FIG. 3.—GENERAL VIEW OF EXCITER SETS.

The large water wheels are connected to Oerlikon alternators through leather couplings. The alternators are rated at 9000 to 10,500 volts, 150 amp, 315 r.p.m. and generate three-phase current having a frequency of 42 cycles. They are of the revolving field type and the winding is of paper insulated copper wire. The stator windings are placed in open slots. The complete machine weighs 37,000 kg and the rotor weighs 13,500 kg. Under test the following results were obtained: The efficiency at full load with a power factor of unity was 95.8 per cent and 92.6 per cent under half load; with a power factor of 0.75 the full load efficiency was 95.2 per cent and the half load efficiency 92 per cent. The temperature rise at full load is 50 deg. Fahr.

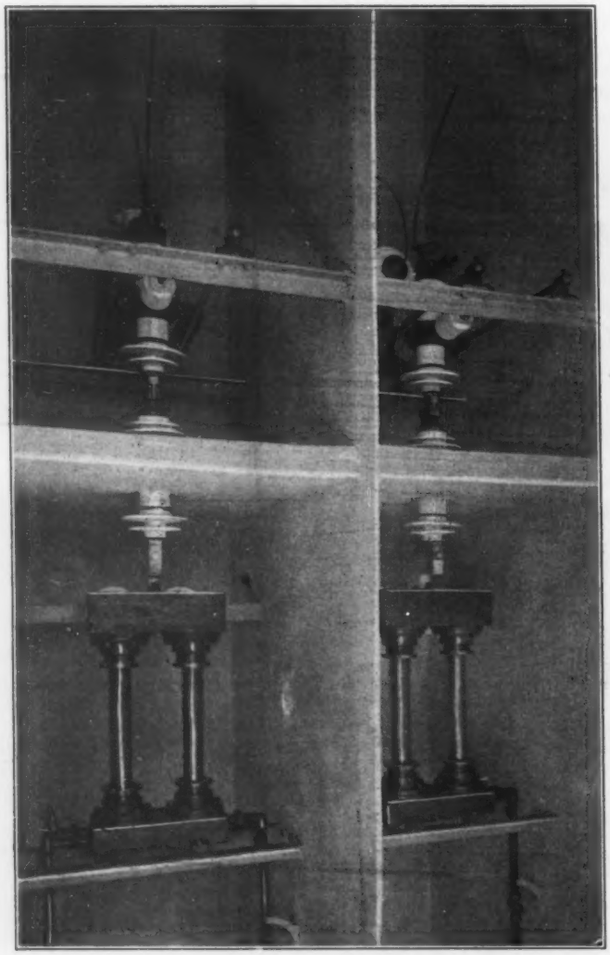


FIG. 4.—HORN LIGHTNING ARRESTERS WITH LIQUID RESISTANCE.

The exciter units are rated at 800 amp and 115 volts. The full load efficiency is 90 per cent with a temperature rise of 66 per cent. Fahr. for commutator and 36 deg. Fahr. for armature. The exciter equipment is shown in Fig. 3.

For the purpose of stepping up the voltage for the transmission circuits to Brescia three oil and water-cooled three-phase transformers are installed. These increase the tension to 46,000 volts. Double cast-iron shells are provided with inside ribs which act as baffles for the circulating water. The secondary coil is wound with bare, flat copper wire, the layers being insulated with pressphan strips. The primary coil is wound externally and is divided into 36 sections coupled in series. The transformers have a normal rating of 150 amp; the ratio of transformation being 9000 to 40,000 up to 10,500 to 46,000 at the generator frequency, the total output being 2720 kv-amp. The transformers were subjected to a test and showed an efficiency at full load with unity power factor of 98.5 per cent. The full load efficiency with a power factor of 0.75 was 98.2 per cent. Each transformer weighs with the oil approximately 12 tons, and is located in a separate cell, as shown in Fig. 5. A track runs in front of the transformer bays so that any one of these can be easily removed in case of necessity.

The switchgear is located in a room adjoining the generator room. The boards are mounted in a recess opening out to the generator room and all high-tension switches are located in concrete cells and interlocked. On the first floor level are the plunger switches and the transformers for operating the

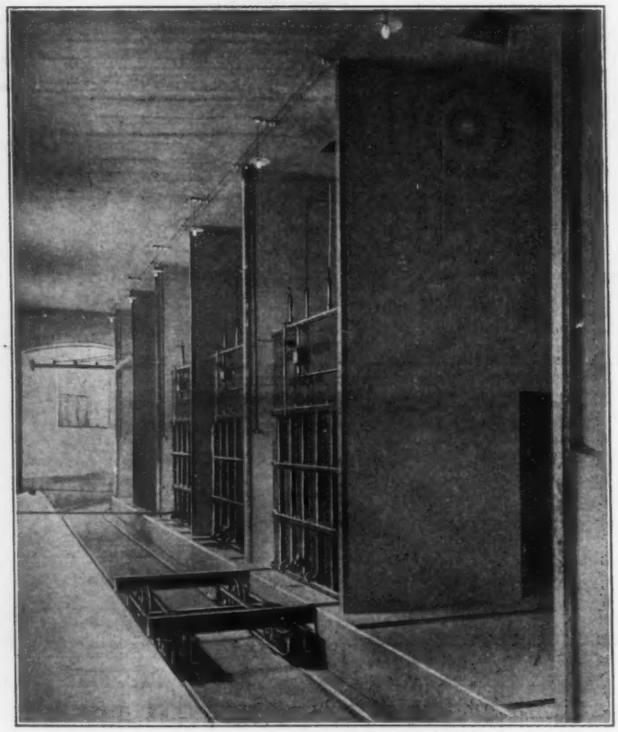


FIG. 5.—TRANSFORMER CHAMBERS.

switches automatically, also the synchronizing transformers. Located in adjoining rooms on the ground floor are the step-up transformers and on the first floor the 46,000 volt oil switches and the high-tension busbars. In the adjacent towers the automatic cut-outs are placed on the first floor and the series transformers and the lightning arrester equipment on the second floor. The top floor is to be fitted with instruments connected with the second generating station when it is completed.

The transformer station at Brescia is about 30 miles distant from the Caffaro station. The equipment in the substation comprises three, three-phase transformers for stepping down the potential from 36,000 to 3600 volts. The transmission line from Caffaro crosses a level tract for a length of about 12 miles, after which it runs up hill and down dale; the highest point being 3000 ft. above sea level, and the Brescia substation being at an elevation of about 500 ft. The transmission line is of copper wire 0.25 in. in diameter, and is designed to transmit 9600 kv-amp with a maximum loss of 15 per cent at a power factor of 0.80; the maximum density is 2.6 amp per sq. mm. In the mountainous sections the transmission poles consist of tripods made of iron pipe and the poles are spaced about 180 ft. apart. When crossing a number of valleys the line is carried

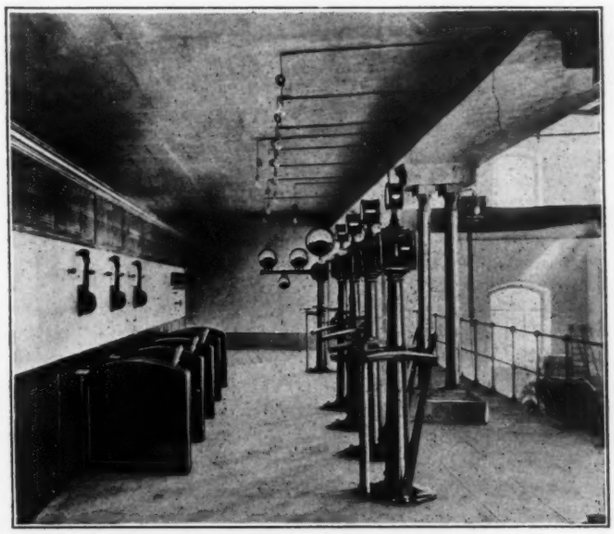


FIG. 6.—SWITCHBOARD GALLERY.

on latticed towers formed of channel iron. The line insulators are of the umbrella type, 10⅝ in. in diameter and 11 13/16 in. high. The insulators are of porcelain and were tested wet under a tension of 90,000 volts. A telephone line connects the stations.

About 2000 kw of the energy generated is utilized in a caustic soda establishment employing the Kellner process. The remainder of the energy is distributed in Brescia and surrounding towns. About 800 hp is held in reserve for use on the railway line joining Brescia and Trento, as this road is expected to be electrically equipped in the near future. For the purpose of supplying direct current to the caustic soda factory in Brescia a motor-generator station was erected near the transformer station and this is fed with 3600-volt, three-phase current. Energy at this potential is supplied to 650 hp three-phase motors which are direct connected to 450 kw, 150 volt generators. The latter are 16-pole machines and have 16 brush-holders each of which holds 13 brushes. There are four of these motor-generator sets installed; an interior view of this station is given in Fig. 2.

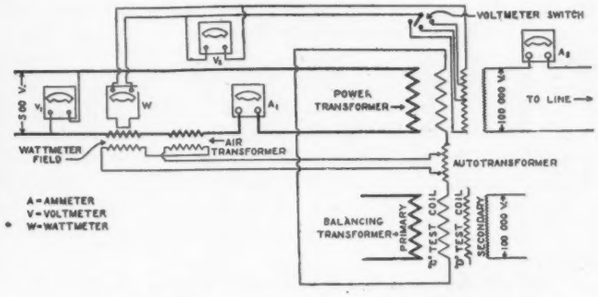
The system is another excellent example of the manner in which the water-powers of the whole great Northeastern region of Italy are being developed. In a general way, most of them are within striking distance of a population that can be immediately benefited by their utilization, and they do not have to await the growth of the country.

Energy Losses Between High-Voltage Conductors.

As mentioned in our issue for July 11, a notable paper on "High-Voltage Measurements at Niagara" was presented by Mr. Ralph D. Mershon at the Atlantic City convention of the American Institute of Electrical Engineers on Tuesday, June 30. An abstract of this paper, together with the discussion brought out by its reading, is given below.

Mr. Mershon reported the results of investigations of the phenomena existing when transmission line conductors are subjected to high alternating voltages. The tests, which were made on two specially-constructed lines at Niagara Falls, were undertaken to supplement the tests made by the author at Telluride, Colo., in 1896, and by Prof. Harris J. Ryan at Cornell University in 1903. The tests at Niagara were carried on more or less continuously from 1904 until 1907. Of the two lines used for the purpose, one having a total length of 2000 ft. and known as the "experimental line," was supported on wooden poles, the line wires being suspended by means of paraffined cords so that the effect of "insulators" was eliminated. The second line, known as the "dummy," was built for the purpose of investigating the effect of the insulators. It consisted of many insulators situated on cross-arms with the minimum permissible lengths of spans between them.

The accompanying illustration shows the arrangement of the testing apparatus. Use was made of two identical specially-constructed single-phase, 10-kw, core-type transformers, each of which was provided with a 500-volt coil, a 100,000-volt coil and a number of low-voltage coils for special observation of wave-shape, voltage, etc. The apparatus was so arranged that all observations were made on the low-voltage side of the transformers, the effect of the iron loss of one transformer being



ARRANGEMENT OF APPARATUS FOR ENERGY LOSS TESTS.

neutralized in the testing wattmeter by the iron loss of the other transformer. Only one of the transformers supplies power to the lines under test, the other being used exclusively for balancing and measurements; the former is designated as the "power" transformer and the latter as the "balancing" transformer.

It was found from the tests at Niagara that certain conclusions deduced from the tests at Telluride have had to be abandoned. Moreover, certain circuit constants suggested by Professor Ryan at the conclusion of his tests must be modified in view of the later tests. As the result of the work at Telluride the work of Professor Ryan, and the tests at Niagara, the author stated that the following conclusions may be drawn:

1. That with a given conductor at a given spacing and under given atmospheric conditions, there is a certain voltage or "critical" point at which a very appreciable loss of energy begins to occur through the atmosphere.

2. That there may or may not be an appreciable energy loss existing below this critical point, depending upon the atmospheric conditions.

3. That the presence of floating particles in the atmosphere may produce a loss below the critical point.

4. That the presence of moisture in the atmosphere may produce a loss below the critical point.

5. That the presence of moisture in the atmosphere affects the loss both above and below the critical point.

6. That the presence of moisture or of floating particles in the atmosphere affects the position of the critical point (that is, the value of the critical voltage).

7. That the critical point corresponds to a partial breakdown of the dielectric.

8. That the critical point coincides with the voltage at which luminosity or hissing (or both) of the conductors begins.

9. That the critical point depends upon the maximum value of the electromotive force wave and the distance between the conductors.

10. That the critical point depends upon the local rate of fall of potential or dielectric stress at some point in the atmosphere and, therefore, depends not only upon the maximum value of the electromotive force wave and the distance between the conductors, but also upon the diameter of the conductors.

11. That there is a loss over insulators which is affected by the moisture conditions of the atmosphere.

12. That the variation of the atmospheric loss between conductors, the variation of the loss over insulators, and the variation of the critical point due to the moisture conditions of the atmosphere bear to the vapor product (that is, the product obtained by multiplying the vapor pressure by the relative humidity) a definite relation which, so far as is at present known, is an empiric one.

13. That the loss over insulators in a fog is very much higher than the loss in dry air, and somewhat higher than that in a heavy rain.

14. That the smoother the surface of the conductor, the less the loss and the higher the critical point.

15. That the stranding of the line conductors reduces the loss and raises the critical point due to the increase of the equivalent diameter of the conductor.

16. That the increase of the equivalent diameter of the conductor is greater the greater the number of strands.

17. That the weathering of conductors (or at any rate the aluminum conductors and probably copper also) does not appreciably increase the loss of energy or lower the critical point.

18. That the loss and critical point are the same for copper and aluminum under the same conditions.

19. That any change in condition which increases the charging current of an insulator increases the loss over the insulator.

20. That the loss over an insulator on a wooden pin is greater than that over an insulator on a metal pin, because the resistance of the wooden pin is in series with the capacity of the insulator.

21. That the atmospheric loss between conductors and the loss over insulators decreases with the frequency. The law of the decrease is not at present accurately known.

22. That neither the critical point nor the loss between cables is affected by variation in the distance of the cables from the ground.

DISCUSSION.

In opening the discussion on Mr. Mershon's paper Mr. H. L. Doherty expressed the opinion that the information recorded in the papers will prove of immense value in connection with the transmission of electrical energy at the higher values of voltage which will be reached in the future. An encouraging feature of the investigation conducted by Mr. Mershon is found in the financial aid obtained by him. The fact that such aid was given shows that financiers appreciate the returns that may be obtained from systematic investigation in electrical phenomena.

Prof. Elihu Thomson explained in detail the physical facts indicated by the results obtained by Mr. Mershon. He stated that the effect of moisture on the loss is attributable to the fact that water vapor is not a true gas, especially when near its condensation point. It represents a gas in a non-staple condition. The gas condenses into water and subsequently is vaporized by the action of the electric stress. He expressed his surprise at the relative increase in the equivalent diameter of a conductor when stranded, and said that further observations should be made of this phenomena.

Dr. Samuel Sheldon said that the discharge between conductors at and above the critical voltage is explainable upon the basis of ionization; tests conducted at Brown University have shown that ions are always present in the atmosphere.

Mr. Henry Floy expressed his appreciation of the generosity of the contributors to the fund for the investigations carried on by Mr. Mershon. He stated his belief that the difference between the values for the critical voltage recorded by Professor Ryan and Mr. Mershon are due to the difference in interpreting the observations, Professor Ryan having employed a visual method and Mr. Mershon a loss method.

Dr. C. P. Steinmetz remarked that the method used by Mr. Mershon in locating the critical point on the loss curve is open to some objection. The curve possesses an upper branch and a lower branch, with a knee connecting the two branches. It should be possible to express the equation of the two branches as logarithmic functions which, when plotted on logarithm paper, become straight lines. The intersection of the two straight lines should be considered as the critical voltage. This value for the critical voltage is higher than that recorded by Mr. Mershon, and approaches more nearly that given by Professor Ryan. He expressed the opinion that it is desirable to calculate the critical voltage on the basis of the local electrical stress which is required to break down the air in the immediate neighborhood of the conductor.

Mr. Percy H. Thomas explained a method by which a quadrant electrometer which consumes no current can be substituted for the current-consuming voltmeter employed by Mr. Mershon, thus avoiding one of the sources of errors in the testing apparatus.

Mr. Carl Hering described a phenomenon observed by him on a high-voltage transmission system where a ring of smoke was formed around each wire when the smoke from a locomotive was blown across the three-phase transmission circuit. This phenomenon indicates ionization of the smoke particles, and serves to explain the decrease in the critical voltage when smoke is present.

Mr. P. N. Nunn expressed the opinion that, in connection with the breaking down of insulators, the maximum local potential gradient along the insulator is of greater importance than the actual loss which may occur over an insulator.

In reply to a question by Mr. P. M. Lincoln, Mr. Mershon stated that the tests recorded in his paper had been conducted on a single-phase circuit, and the results would probably be somewhat different on a three-phase system. He stated that he hopes to continue investigation until electromotive forces as high as 300,000 volts have been reached.

A. I. E. E. Papers on Technical Education.

The session of the convention of the American Institute of Electrical Engineers held on Thursday afternoon, July 2, at Atlantic City, was devoted to the presentation and discussion of papers dealing with the college training of engineers by Mr. M. W. Alexander, Mr. D. B. Rushmore and Mr. B. A. Behrend, as briefly noted in our issue for July 11. Abstracts of these papers and of the discussion following their presentation are given below.

THE TRAINING OF ENGINEERS.

A paper by Mr. Magnus W. Alexander described a so-called co-operative method of training engineers. According to the plan proposed the student spends six years, as at present, in acquiring technical education and factory experience. It differs from the usual method in that the first five years would be spent in alternate periods at the college and at the factory, leaving the sixth year to be devoted entirely to college work. The periods should increase in duration from the first toward the last year of the course, beginning with alternations of one month's duration and ending with time elements of college semester.

THE MANUFACTURING COMPANY AND THE TECHNICAL GRADUATE.

In a paper dealing with the relation of the manufacturing company to the technical graduate, Mr. David B. Rushmore stated that among the things that a man learns at college the

most important is to do team work and not to act as an individual, because a large part of the effectiveness of an organization depends upon just such work. Co-operation is the watchword of modern industrial development. Organization is one of the most important factors in present industrial conditions. An organization means an aggregation of individuals each of whom is performing some more or less specialized function, but all working harmoniously together to a common end. Many men never learn that they are part of an organization, and persist in working as individuals and, therefore, lose much of their value to a large concern. To get the advantage of a large organization everybody's mind must be used for the whole. The best organizations allow a free development of individuals, while restricting them to harmonious action. Initiative must be rewarded, suggestions freely accepted, and a healthful rivalry carefully watched and, if necessary, restricted. An individual entering a large concern becomes at once a member of an organization and must work as such. The entire line of thought and action is very different from a condition where he performs all functions himself. The ability to work as part of an organization can be largely acquired, and should be learned in a college course.

THE MANUFACTURING COMPANY AND THE TECHNICAL GRADUATE.

In a paper discussing the relation of the manufacturing company to the technical graduate, Mr. B. A. Behrend stated that the college possesses an almost unlimited potentiality for improving the human material turned over to them to shape and polish, and expressed the opinion that they are doing very well in the shaping and polishing process, but they are not always supported in the right direction by the manufacturing companies. There is abroad among graduates a most ominous disdain for painstaking accuracy and devotion to laborious detail, so essential to all really great work in engineering. This result is attributable to present business methods, which are not much concerned with a debt of gratitude or obligation to the men that do the building-up, thereby discouraging technical graduates from the pursuit of new and important creative engineering work. Close co-operation between the manufacturing companies and the colleges is desirable in order that both character and intellect may be cultivated in the graduates.

DISCUSSION.

The discussion on the educational papers was opened by Prof. J. P. Jackson who stated that, in so far as a college graduate fails to reach the standard which engineers desire, the engineers are equally as much to blame as the college professors. Professors are willing and anxious to arrange the courses in college to conform to the wishes of the engineers. The difficulty is that engineers are willing to criticise, but not so ready to offer suggestions as to changes. He proposed that the practising engineers should connect themselves with colleges in the capacity of consulting professors in order that colleges may obtain the benefit of suggestions from them. Professor Jackson stated that in the teaching of history too much stress is laid upon facts of minor importance and not enough is placed upon the elements which have contributed to the advancement of civilization, such as inventions, discoveries and the introduction of improved means of transportation of materials and intelligence.

Mr. B. A. Behrend said that the method described by Mr. Alexander represents one of the most dangerous innovations of recent years. The combination of shop work and class work possesses too many elements of distraction and not enough of concentration.

Prof. Morgan Brooks stated that Mr. Alexander's method would prove impracticable for most universities. The students entering colleges are usually too young to undertake such a course with any degree of seriousness. The method is disadvantageous in that elective studies could not be pursued in combination with it.

Prof. H. H. Norris explained that a college must arrange its courses so as to afford a proper training for the college students rather than for the lowest or the highest man in the class. The method of training must be such as to encourage individuality in the student. He stated that the mind of a student is subjected to a certain time-lag when work is undertaken immediately after a vacation. Thus, interspersed shop periods and college periods would result in a considerable loss of time while the students' minds were becoming adjusted to the different conditions. He said that the best plan is to give some training in the college shops before the student attempts outside work. However, it is advantageous for the student to keep in touch with college affairs when he is serving an apprenticeship with a manufacturing company. A suitable method of promoting such interest in college affairs is found in the offering of advanced degrees for outside work subsequent to graduation.

Dr. C. P. Steinmetz said that on account of the fact that the amount of time that a student can spend in college is limited it is essential for him to be instructed along those lines in which it would be difficult or impossible for him to receive instructions outside of college. A training which attempts to fit a student for practice immediately upon graduation is defective because in order to obtain such results a considerable portion of the student's time must have been spent in acquiring the knowledge of practice which could with advantage be acquired after graduation, while the other subjects of greater importance must have been neglected. He stated that colleges as conducted at the present time are subjected to a great handicap in that they are compelled to turn out an acceptable product although the raw material may be defective. The college courses should be so arranged that the instructors' time will not be wasted in attempting to produce engineers from material which is not suitable for such a product. As college courses are conducted at the present time, the best students are held back by the inefficient men of the class.

Prof. D. C. Jackson stated that educational courses should be so broadened that electrical engineers will have a considerable knowledge of civil, mining and mechanical engineering, etc. He expressed the opinion that Mr. Alexander's method possesses merit in that it adds an apprenticeship course to the college course and improves on each of these courses.

Prof. C. A. Adams thought that a systematic effort should be made to eliminate unfit students in order that instructing work might be concentrated on the teaching of students capable of becoming engineers.

Prof. A. F. Ganz did not approve of the method proposed by Mr. Alexander, but expressed the belief that it would be better for the students to leave college between the third and fourth years in order to spend one year in actual practice.

Mr. G. S. Dunn said that the carrying out of Mr. Alexander's method would render the contact between the manufacturing companies and the college entirely too intimate, and that the scheme proposed possesses many features to render it impracticable. Quite independent of the method of instruction that may be used, the best results will be obtained only when proper care is taken in the selection of the proper men for students, instructors and professors in the colleges.

Telephonic Transmission.

The June number of the *Physical Review* contains a paper by L. Cohen in which the author determines mathematically the effect of inserting a receiver at the end of a transmission line. The effects in a short line (30 km) and in a long line (300 km) are calculated. For the short line it is found that the receiver in the circuit increases the distortion, but that the introduction of a condenser will improve the transmission. While telephoning at such a short distance as 30 km is possible with almost any apparatus, yet there is still considerable room for improvement and it would seem that the introduction of a condenser of the proper magnitude in series with the receiver ought to produce good results. In the case of a long line (300 km) the introduction of the telephone receiver does not materially influence telephonic transmission.

Effect of Oil on Dielectric Strength of Insulating Cloths, Papers and Varnishes.

An investigation into the effect of oil on the dielectric strength of insulating cloths, papers and varnishes was made this year at the Worcester Polytechnic Institute by Messrs. L. H. Hitchcock and F. E. Wood, the results being presented in a thesis. As the subject is one of interest in connection with transformer design, some of the particulars of this investigation are given below.

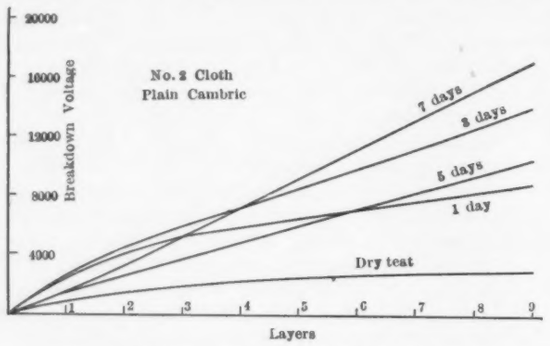


FIG. 1.—INSULATION TEST OF PLAIN CAMBRIC.

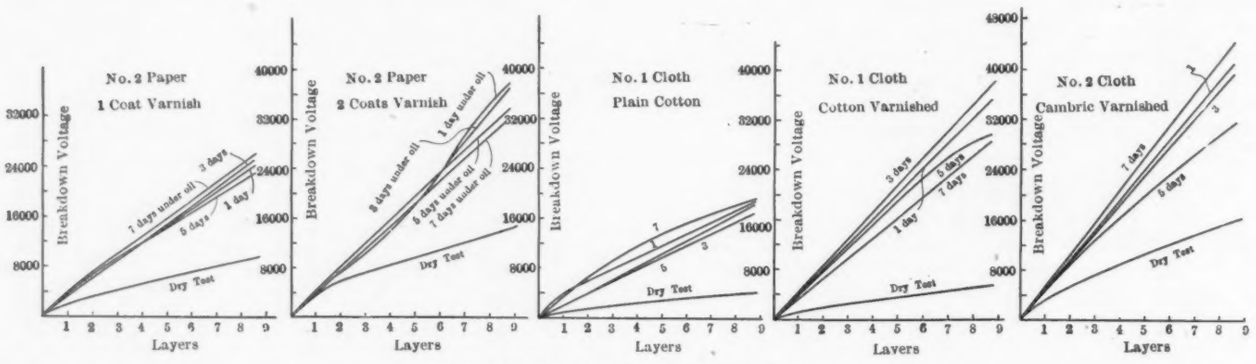
One kind of oil, two kinds of paper, two kinds of cloths and one kind of varnish were tested. Transit oil was selected and the paper tested was, first, a grade of light-brown medium-weight manila, and, second, a thin brown paper, such as is used in making insulating tubes. The cloth selected was common unbleached cotton cloth and white cambric and the varnish was made by E. Coleman & Company, New York, and is known as "Clear Elastic Insulating Varnish." The paper and cloths were coated with varnish to enable the effect of the oil on the varnish and the varnish on the cloth to be studied. The paper was varnished by brush with one and two coats, and the cotton cloth was dipped. The cambric was first varnished with the brush, and excess varnish removed by passing the strips through a frame. The test pieces were 4-in. squares, the average thickness being determined by micrometers.

For the lower potential tests a 25,000-volt transformer was used, and for the higher a 220,000-volt transformer, both having been built at the institute. For measuring the higher voltages a repulsion voltmeter was used, and the potentials from the smaller transformer were measured by a Braun electrostatic voltmeter.

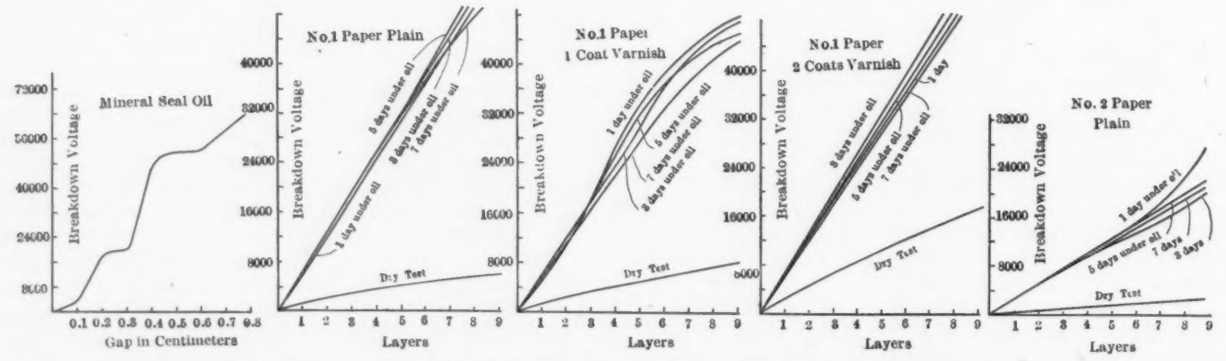
	Av. thickness per layer.
Paper No. 1. Light brown manila.	
Plain	.0056″
1 coat varnish	.0057″
2 " "	.0066″
Paper No. 2. Dark brown thin grade.	
Plain	.0021″
1 coat varnish	.0025″
2 " "	.0026″
Cloth No. 1. Common unbleached cloth.	
Plain	.0103″
Varnished	.0120″
Cloth No. 2. Common white cambric.	
Plain	.0050″
Varnished	.0071″

In making the tests it was decided to compare the dielectric strength of different thicknesses of each kind of material, the maximum being nine thicknesses. Tests were made on the material when it was dry and also after oil treatment for various lengths of time. The oil was tested by a micrometer spark-gap in an insulated tube. The repulsion voltmeter was calibrated by the spark-gap method and the Braun meters by comparison with a standard instrument. The Braun meters were placed across the transformer secondary when in use. The paper and cloths were as given in the above table.

The results of the tests are given in the accompanying curves. It appears that the insulation was strengthened by the varnish in every case, but the effect was least marked with the cloth. All materials were greatly benefited by the oil treatment, but no general statement can be made as the influence of the time factor is beyond the limits of the tests.



FIGS. 2, 3, 4, 5 AND 6—INSULATION TESTS.



FIGS. 7, 8, 9, 10 AND 11—INSULATION TESTS.

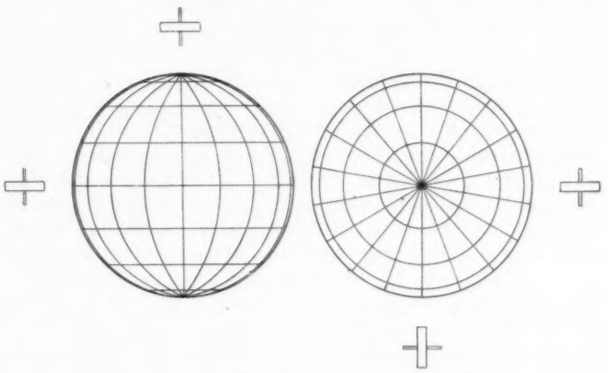
Some Interesting Features Concerning Gyroscopes.

By George T. Hanchett.

The electric motor has made possible the production of a gyroscope which can be used as an instrument of precision or a device to improve the stability of boats or a support to monorail trains. The writer has been indulging as a pastime in some practical experimentation on the subject of gyroscopes and even went so far as to improve independently upon Foucault's experiments, only to find that ages ago brilliant minds had worked on the subject when it was utterly impossible to produce a satisfactory and practical gyroscope continuously operating. It is certainly impressive to look over some of these old patents on the gyroscopic principle, perfect mathematically, but practically worthless because of the necessity of resorting to steam jets or some adequate means to keep the gyroscope wheel in motion.

In spite of the fact, therefore, that much that follows is ancient history, it is far from well known and should be of general interest, because it makes possible apparatus of precision for the determination of latitude, longitude and sidereal time, and, furthermore, is of astronomical value in the control of telescopes and of probable value in telescopic photography. As all of this is made possible by the use of the electric motor, reference to it can properly be made in the electrical press and may be of possible interest.

The law of the gyroscope is the first law of motion, which in plain terms is that a particle impressed with motion will continue to move in a straight line. The particles in the heavy rim of the gyroscope wheel, once set in motion, cannot continue to move in a straight line because of the centripetal action of the structure in which they are mounted, but they can and do continue motion in the same plane and this plane is fixed in space.



FIGS. 1 AND 2.—GYROSCOPE EXPERIMENTS.

The plane of the gyroscope, or its axis, then becomes an accurate indicator of the initial direction in which it has been started, and if the apparatus be supported in universal gimbals, any motion of the support of the gyroscope will be indicated by an apparent motion of the gyroscope within its gimbals, and if the latter be properly graduated, the variation can be observed in degrees, minutes and seconds.

Thus, if a gyroscope is started with its axis parallel to the axis of the earth, this parallel relation will exist as long as the gyroscope is kept in rotation, no matter where the gyroscope be moved upon the surface of the earth. If the gyroscope be moved to the pole its axis will point vertically downward at right angles to a level line. If it be moved to the equator, it will point horizontally or parallel to a level line, and at any intermediate position it will be at an angle with a level line and, be it observed, the angle that the gyroscope axis makes with the level line is the geographical latitude of the instrument, assuming that the earth is a perfect sphere. (See Fig. 1.)

Similarly if the gyroscope be started with its axis at right angles to the axis of the earth, say, for instance, pointing at the star Vega, when the latter is at the zenith in midsummer, the gyroscope will continue to point its axis at the star and as the earth revolves the gyroscope axis will follow the star not only to the horizon, but under the horizon and up on the other side, making one complete revolution in one sidereal day. If the gyroscope be connected by a suitable train of gears to the hands of a clock, this clock will keep true sidereal time and will become a primary standard for time, for the apparatus which drives it is geared to the earth in the ratio of one to one. (See Fig. 2.)

Returning again to the conception of the gyroscope with its axis pointing at a star of the correct latitude in the heavens to make its axis at right angles with the earth's axis, it will be observed that as the instrument is moved from place to place upon the surface of the earth, the gyroscope will continue to point to the star and keep with it. If time throughout the world were taken from this particular star, the gyroscope would keep time in the place where it was located and not with reference to any set meridian, and, of course, it is easy to arrange the setting of a clock in conection with the gyroscope so that it will keep this time. Accordingly, if the readings of this clock be compared with the readings of a clock or chronometer set to Greenwich time the difference between these readings will represent the difference in time between the place of observation and the meridian of Greenwich, from which longitude can be readily computed. All of this, it will be observed, is accomplished without the use of any astronomical observations.

The gyroscope can, furthermore, be used to direct the axis of a telescope which it is desired to keep upon a fixed star, either by connecting it to some form of sidereal movement and causing it to drive the right ascension axis of the telescope, or by fastening it directly to the telescope itself, fixing the telescope on the star and starting the gyroscope. The latter plan perhaps presents some difficulties in the matter of perfect balance of the instrument and slight vibration might be found somewhat troublesome.

An interesting commentary on the use of the gyroscope is found in a serious consideration of what will happen in trains or boats depending upon the gyroscope for their means of stability. Much has been said of monorail trains made stable by the gyroscope, and as it is a fruitful field for the exploitation of working models and stock certificates, it may be wise to remember that a gyroscope powerful enough to support a train would also be powerful enough to cause the train to turn a complete somersault every 24 hours as the earth revolves, provided its axis was not parallel with the earth's axis. If it were parallel with the earth's axis the motion of the earth would have no effect upon it, but its stability would be destroyed at all places except the poles, and it would get into serious trouble whenever it attempted to change its latitude.

For short runs with frequent stops and starts, these things are not noticed, and, indeed, in trains going long distances some of the evils could be corrected by stopping the train and propping it up, stopping the gyroscope and giving it a new start, and it is probable that the distress that the gyroscope would exhibit upon its bearings would be sufficient warning of this necessity.

Some of these things will be brought home keenly to some of the older members of the profession when they remember the trouble experienced with the gyroscopic action on discoidal armatures on board ship. The old Brush machine for incandescent lamps, now obsolete, is a familiar example. It will be remembered that it was found wise to preserve the bearings by setting such machines so that their axes ran fore and aft, as the action on the bearings due to rolling was more severe than the action due to pitching.

Insulating Varnish.

Mr. E. A. Beyer at a recent meeting of the Cologne (Germany) Electrical Society read a paper on insulating materials, and especially on varnishes. As a special advantage of the varnish made by a German company it is claimed that it is much less inflammable than American insulating varnishes; the latter are claimed to be made with easily inflammable benzine, and this should be avoided.

Parallel Operation of Transformers.

By E. G. Reed.

THE parallel operation of two or more transformers implies their being connected, jointly carrying the load, so that an individual unit may be added to or taken away from the group with no other effect than decreasing or increasing the load on the remaining transformers. In order that this may be accomplished, the ratio of the primary to the secondary voltage of each unit must be that of the supply to the load circuits, respectively. (See Fig. 1.)

The measure of the satisfactory parallel operation of a number of transformers is the manner in which they divide the common load. If the individual units have the same rating they should share the load equally. If they are different in rating, the load taken by each unit should be proportional to its rating. Moreover, when the transformers are connected in parallel, there should be no "interchange" current between them.

CONNECTED FOR PARALLEL OPERATION.

On analysis, the problem of paralleling transformers resolves itself into a particular case of the parallel operation of alternating-current generators. In order that two generators may operate satisfactorily in parallel, they must be running at the same frequency, their voltages must be in phase, and be equal in magnitude. Similarly for the satisfactory parallel operation of transformers, their secondary voltages must be in time-phase and equal in value, being connected to the same supply system they will be in synchronism.

The secondary terminal voltage of a transformer is practically opposite in phase to the voltage impressed on its primary. Consequently, two transformers connected as shown in Fig. 1, being excited from the same circuit, have secondary terminal voltages which are in synchronism and in time-phase. It is assumed that the two transformers shown in Fig. 1 have similar coils, such that the relative direction of the primary and

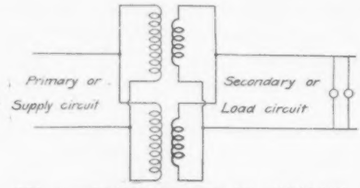


FIG. 1.—TRANSFORMERS IN PARALLEL.

secondary windings is the same in the two units. If this were not the case the secondary voltages instead of being in phase, would be in opposition, and the connection shown would be inoperative, the action being the same as though there were a short-circuit in each transformer. The term "in time-phase," referring to the secondary voltages of transformers in parallel, is used when considering the transformer voltages relative to the load voltage. If the secondary windings of two transformers be considered as forming a series circuit, the secondary voltages must be thought of as being in opposition, since the correct parallel connection is such that no considerable amount of electricity may flow from one transformer to the other.

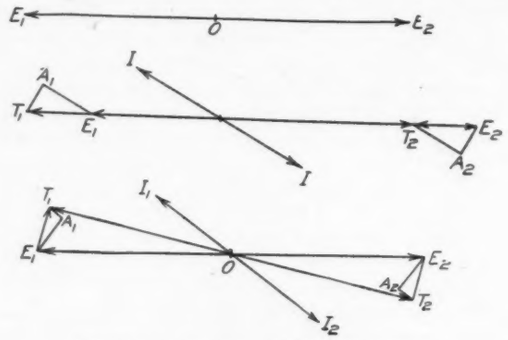
If the phase relation and magnitude of the voltages in the secondary windings of two transformers connected in parallel, but without external load, be such, considering the windings as a series circuit, that there is no tendency for a current to be produced, the vector relation of these voltages may be represented as in Fig. 2. In this drawing OE_1 represents the secondary voltage of one transformer in magnitude and direction and OE_2 in a similar manner, the voltage of the other.

In certain cases, the voltage ratio of the two transformers may not be exactly the same, giving secondary voltage differing in value, in which case there will be a resulting voltage tending to produce a current locally within the two transformers.

This circulating current produces within the two transformers impedance drops which when added to the induced voltages bring the terminal pressures in opposition and equal in value. This is shown in Fig. 3. The current OI in the transformers produces impedance drops $E_1 T_1$ in the first transformer and $E_2 T_2$ in the second. These impedance voltages are made up of the resistance elements $A_1 E_1$ and $A_2 E_2$ in time-phase with the current I and the reactive elements $A_1 T_1$ and $A_2 T_2$ in time-quadrature to I. These impedance voltages when added vectorially to the voltages OE_1 and OE_2 produce the terminal voltages OT_1 and OT_2, which are equal in value and opposite in time-phase.

LOAD CONDITIONS.

It has been shown that for two transformers connected in parallel, without external load, the vector relation of the voltages may be indicated as in Figs. 2 and 3. Fig. 2 shows the con-



FIGS. 2, 3, AND 4.—VECTOR RELATIONS.

dition when the secondary induced voltages OE_1 and OE_2 are equal in value, and Fig. 3 shows where they are not equal.

If, now, an external load be thrown on the transformers they will divide the load in such a manner that the terminal voltages OT_1 and OT_2 are still equal in value and opposite in phase.

When the secondary induced voltages are equal in value as shown in Fig. 2, the load conditions are as shown in Fig. 4, where OI_1 and OI_2 represent the currents taken by the two transformers. These currents are of such relative values that the impedance drops $E_1 T_1$ and $E_2 T_2$ when added to the induced voltages OE_1 and OE_2 give secondary terminal voltages OT_1 and OT_2, which are equal in value and opposite in time-phase. Since OE_1 and OE_2 are equal and OT_1 is equal to OT_2, it follows that $E_1 T_1$ is equal to $E_2 T_2$. This is based on the assumption, as will be explained later, that the ratio of the resistance to the reactive drop for one transformer is equal to the ratio of the same quantities for the other unit.

The relative distribution of the load current between any two transformers under these conditions is such that the currents in the two transformers are inversely proportional to their impedances.

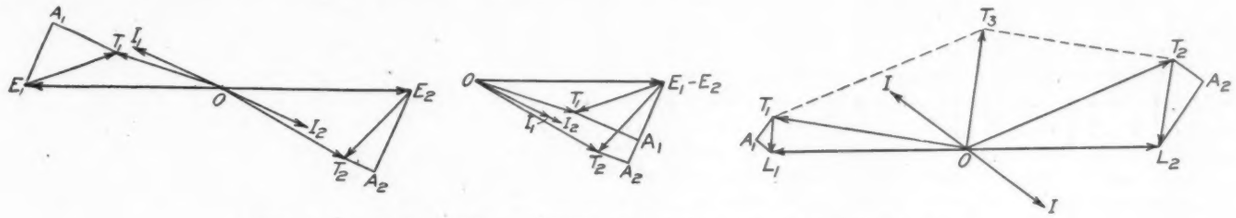
It has been shown that unequal secondary induced voltages are the cause of a circulating current. Another cause for the production of a local current between the transformers may arise under load conditions. Consider two transformers in parallel in which the ratio of the resistance to the reactance drops are not equal. The division of the load is now not necessarily such that the impedance drop in one transformer is equal to the impedance drop in the other unit. The impedance drops being not in opposition, when they are added to the secondary induced voltages, the resulting pressures also are not in opposition. A circulating current then is necessary to bring the terminal voltages into this relation, and the division of the load between the transformers will be such as to make this circulating current a minimum.

The resistance element of the impedance drop is always in time-phase with the load current, therefore, its time-phase relation is fixed. The reactive element being always in time-quadrature to the resistance element is also fixed as far as its time-phase relation is concerned. The impedance drop itself, being the sum of these elements, varies in time-phase as their relative value changes.

This condition is shown in Fig. 5, the impedance drops being $E_1 T_1$ and $E_2 T_2$, the ratio of the resistance drop $A_1 T_1$ to the

reactive drop A_1E_1 being, for example, unity for the first transformer and the ratio of A_2T_2 to A_2E_2, being, say, 1-to-3 in the second transformer. Under these conditions, the voltages OT_1 and OT_2 will not be in time-phase opposition. By referring to Fig. 6, where the impedance triangle $A_1E_1T_1$ is superimposed on $A_2E_2T_2$, it will be seen how much the impedance drops E_1T_1 and E_2T_2 vary in time-phase opposition.

In so much as E_1T_1 and E_2T_2 are not opposite in phase nor equal in value, a circulating current must be produced, the resulting impedance drops bringing the terminal voltages in time-phase opposition and equal to each other. This condition is shown in Fig. 7. Under these conditions OT_3 is the resulting voltage tending to circulate current. The current I in the windings of the transformer produces impedance drops T_1L_1 in one transformer and T_2L_2 in the other. These impedance drops are, of course, opposite in time-phase to OT_3, and the sum of T_1L_1 and T_2L_2 equals OT_3. The impedance drops T_1L_1 and T_2L_2 when added to OT_1 and OT_2 give resulting terminal voltages OL_1 and OL_2, which are opposite in time-phase and equal in value.



FIGS. 5, 6 AND 7.—VECTOR RELATIONS OF CURRENTS AND ELECTROMOTIVE FORCES.

It has been shown that the distribution of current in two transformers in parallel is such that the circulating current is a minimum. Aside from this distribution, the circulating current, if present, will add to the current in one transformer and decrease the current in the other unit. There are two causes for the circulating current, first, an inequality of voltages, and, second, voltages out of phase due to the relation of the resistance and reactive elements of the impedance.

The true current distribution is the result of the two currents enumerated, and it is possible that both may exist in the same transformer.

POLARITY OF SINGLE-PHASE TRANSFORMERS.

If two transformers are connected for parallel operation, the phase relations of the secondary voltages must be such that with no external load the current produced locally between the two units will not be large. Considering the secondary winding of the two transformers as a series circuit, the voltage of one must be practically in time-phase opposition to that of the other in order that this condition be fulfilled. If the voltages of the two windings were in time-phase, a very large current would be produced and there would be in effect a short-circuit on both units.

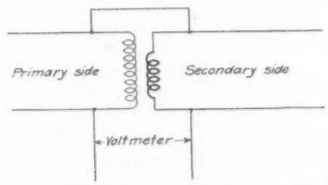


FIG. 8.—CONNECTION FOR TESTING VOLTAGE RELATIONS.

If two transformers are connected in parallel and a large current is produced between them, the position of either the primary or secondary terminals of one of them must be interchanged. This will reverse the time-phase relation of the secondary voltage of that particular unit, and the condition for parallel operation will be established.

In connecting transformers in parallel, as in Fig. 1, it was assumed that the relative direction of the primary and secondary windings was the same on one unit as on the other, in which case similarly located leads are to be connected together. Transformers which may be so connected, that is, with similarly located leads connected together, are said to have the same polarity. If leads which are not similarly located are required to be connected together in order to obtain this relation, the transformers are said to have opposite polarity.

Transformers of a given type have the same polarity, a standard polarity being necessary so that the transformers may be connected always in the same manner. Transformers of the same class, for example, distributing transformers, even when manufactured by different companies, usually have the same polarity.

If a transformer be connected as shown in Fig. 8, the value indicated by the voltmeter will be the sum of the voltages of the supply and load circuits. Whether the voltmeter will indicate the numerical sum or difference of the supply and load voltage will depend upon the relative directions of the windings on the two transformers. The two transformers have the same polarity if the voltages indicated by a voltmeter connected on first one and then the other, as in Fig. 8, are the sum of the supply and load circuits for both units, or are in both cases the difference of these voltages.

POLARITY OF THREE-PHASE TRANSFORMERS.

It has been shown that if two similar single-phase transformers be connected in parallel, and a condition results which is not operative, it is only necessary to reverse either the primary or secondary connections of one transformer and the difficulty will disappear. With three-phase transformers, the problem is not so simple, and the different methods by which the coils may be connected may result in conditions in which it is not possible to parallel one transformer with another connected differently, by any possible interchange of leads on the outside of the case. This will be seen by comparing the usual methods of connections with the corresponding vector diagram of voltages, as shown in Figs. 10, 11, 12, 13 and 14.

The sketches represent either the primary or secondary windings and the relations of these windings on the three core legs is assumed to be always the same; that is, the polarity of the coil on each leg remains the same. As shown in Fig. 9, the two methods of representing the direction of the winding in a coil are identical. Method *b* is used in preference to *a* because of its simplicity. As shown in Figs. 10, 11, 12 and 13, the coils are all wound alike. Figs. 10 and 11 show star-connected windings. In the first case the neutral connection is made at the bottom of the coils and in the second at the top of the coils. The magnetic circuit, for the sake of clearness in the drawings, is omitted, but is understood to be present. No matter how the individual coils are connected, the magnitude and time-phase of the voltage produced by each remains constant.

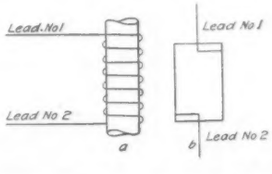


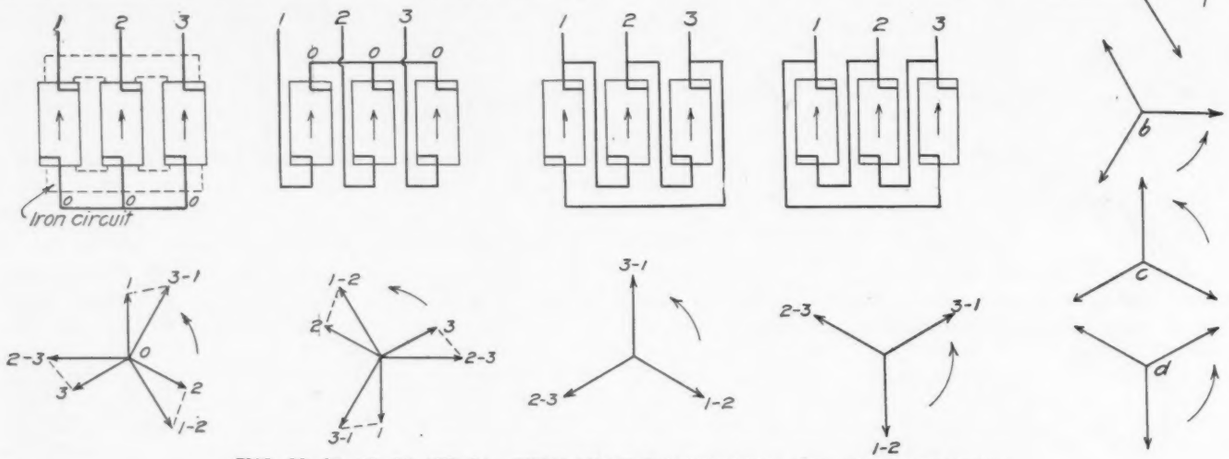
FIG. 9.—REPRESENTATION OF SINGLE-PHASE TRANSFORMER.

If 01, 02 and 03 represent the voltages between the corresponding leads on the coils in Fig. 10, 1-2, 2-3 and 3-1 represent the voltages between the terminals of the transformer, namely, 1, 2 and 3. It will be noted that changing the neutral

connections from the top of the coils to the bottom shifts the voltages between the terminals of the transformer by 180 time-degrees. In Figs. 12 and 13, showing the two methods of making the delta-connection, the second method of connecting shifts the terminal voltages by 300 time-degrees.

There are now three-phase terminal voltages, the relative time-phase relations of which are shown by *a, b, c, d,* in Fig. 14.

The primary windings of a given transformer may be connected to give voltages shown in *a, b, c* and *d,* Fig. 14, and the secondaries may be connected similarly. This makes possible 16 different connections on one transformer, and the problem is to



FIGS. 10, 11, 12, 13 AND 14.—THREE-PHASE TRANSFORMERS AND VOLTAGE RELATIONS.

determine how many of these combinations will allow one transformer to be paralleled with another transformer having the same possible connection.

In this discussion it is assumed that when paralleling transformers, leads 1, 2 and 3 on either the primary or the secondary side are connected to leads correspondingly numbered on the second transformer.

Those combinations will operate in parallel in which the primary and secondary voltages are out of time-phase by the same amount.

The following table gives the combinations possible:

Combinations—Primary.	Combinations—Secondary.	Angular displacement.
a	a	0°
a	b	60°
a	c	30°
a	d	90°
b	a	60°
b	b	0°
b	c	90°
b	d	30°
c	a	90°
c	b	30°
c	c	0°
c	d	60°
d	a	30°
d	b	90°
d	c	60°
d	d	0°

From an inspection of this table it is evident that combination *a-a* will parallel with *b-b, c-c* and *d-d*; combination *a-b*

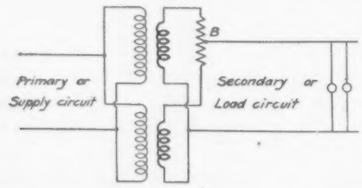


FIG. 15.—USE OF COIL FOR BALANCING LOADS ON TWO TRANSFORMERS.

with *b-a, c-d* and *d-c*; combination *a-c* with *b-d, c-b* and *d-a*; combination *a-d,* with *b-c, c-a* and *b-b.*

USE OF BALANCE-COIL IN PARALLELING TRANSFORMERS.

It has been shown that the load current in two transformers connected in parallel so divides that the terminal voltages of the two units are equal in value and opposite in time-phase. In case this distribution of the current is not that desired, it is possible, by inserting a balance coil at *B,* in Fig. 15, to force the transformers to divide the load between them in any ratio required.

The balance-coil, shown in Fig. 15, is a single continuous winding on an iron core, having a tap at some point between its two ends. This tap is so located that when the desired current distribution is obtained, the ampere-turns on the two sides of it are equal. Since the balance-coil absorbs the voltage tending to produce a circulating current, this current is reduced to a value only sufficient to magnetize the core of the coil. The ampere-turns on the two sides of the tap neutralize each other as far as any magnetizing effect on the core is concerned.

It is difficult to predetermine the value of the voltage tending to circulate current for a particular case of parallel operation. For this reason the balance-coil should be designed with a fairly low flux density in its core, so that, if the voltage is greater than expected, the increased flux will not saturate the core sufficiently to require a magnetizing current, which in this case will be the current circulating between the transformers.

Balance-coil may be used in paralleling three-phase transformers, and although the application is not so simply explained as for single-phase operation, the principles involved are the same.

Magnetic Testing.

At the meeting of the American Society for Testing Materials held at Atlantic City on June 26, Mr. Chas. W. Burrows presented a paper entitled "Uniformity in Magnetic Testing and in the Specifications of Magnetic Properties," which dealt with the determination of the magnetic data of straight bars of iron and steel. The author stated that the apparatus for this purpose may be intended primarily for commercial testing or primarily for the use of a standardization laboratory where the highest accuracy is demanded.

COMMERCIAL PERMEAMETERS.

The present paper deals with the determination of the magnetic data of straight bars of iron and steel. Apparatus for this purpose may be primarily for commercial testing or primarily for the use of a standardizing laboratory where the highest accuracy is demanded.

A good commercial permeameter should have few or no delicately adjusted parts to get out of order. It should be so simple of manipulation that a skilled experimenter is not required. It must yield results rapidly and consistently. It should be adapted to a specimen which may be prepared readily and cheaply. Any corrections that are to be made should not be too complicated and should be susceptible of verification.

One of the best known of the commercial permeameters is that invented by Koepsel in 1890. It is shown diagrammatically in Fig. 1. The test specimen is placed within the magnetizing coil *C* and firmly clamped by means of thumb screws to the heavy quadrantal yokes. These yokes embrace the moving coil to which is attached a pointer moving over a scale. A fixed electric current in the movable coil causes a deflection proportional to the flux in the specimen. By proper adjustment of the constants, the flux and magnetizing force may be read directly from the scale of the instrument and an ammeter in

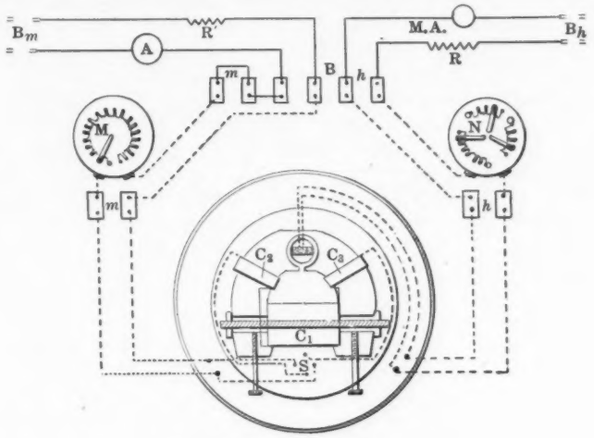


FIG. 1.—KOEPSEL PERMEAMETER.

series in the magnetizing circuit. The instrument is of the moving-coil galvanometer type, except that the current is kept constant and the field strength is varied.

Esterline in 1897 modified this apparatus by replacing the moving coil by a revolving armature driven by a motor. The e.m.f. generated is proportional to the flux in the specimen, and may be measured by an ordinary voltmeter.

Carpentier (1903) placed a moving magnetic system over the air-gap, and, by means of a torsion fiber, balanced the resultant torque.

These three instruments might be placed at the head of a long list of apparatus intended for rapid magnetic work. The first two, in addition to the qualities already enumerated as desirable, are direct reading. For accurate commercial work they are all subject to certain corrections which may be expressed in the form of a correction curve. The correction is a function of the flux but depends somewhat on the quality and form of the specimen. Consequently it is desirable to calibrate a commercial instrument with a standard rod of approximately the shape and quality of the specimens to be measured. If a wide range is desired there should be more than one calibration.

STANDARDIZING APPARATUS.

In the second class of magnetic apparatus, that intended for standarizing rods to be used in the calibration of commercial apparatus, simplicity and rapidity of operation are less important, but higher accuracy is required. In these absolute determinations there must be no correction factors except those susceptible of calculation or elimination.

In Rowland's ring method (1873) there are no end effects to be corrected. In the magnetometric method using an ellipsoid the end effects may be calculated. Cylindrical specimens, however, are not adapted to these methods. The only methods suitable for straight bars are the Ewing double-yoke and double-length method described in 1896, the Picou method described in 1902, and the method employed at the National Bureau of Standards, which has not yet been published.

In Ewing's double-yoke and double-length method two rods and two small yokes form the sides of a rectangle. Complete sets of data are obtained for each of two different lengths of the same rods. From these two sets of data it is possible to eliminate the effect of the yokes and thus obtain the magnetic data for the rods alone.

This method assumes that the flux is uniform along the specimen and also that the two rods are magnetically equal. These two assumptions are not fully met and it is impossible to estimate the magnitude of the error. Furthermore it requires two specimens and a double set of data, thus giving greater chance for experimental error.

The yokes in the Picou apparatus consist of two U-shaped pieces between the ends of whose legs the test specimen is clamped. Magnetizing coils are wound around the yokes and also around the specimen. The magnetizing coils which surround the yokes are first connected so as to magnetize the two yokes in series, as shown by the dotted lines and arrows in Fig. 2. In this arrangement these coils furnish magnetomotive force enough to overcome the reluctance of the yokes and joints and twice the thickness of the rod. No flux, however, passes longitudinally through the specimen. The current is then reversed about one of the yokes, thus putting the yokes magnetically in parallel with each other and in series with the test rod, as shown by the dot and dash lines and arrows. A sufficient current is then passed through the coil surrounding the specimen to overcome the extra magnetic reluctance added by the specimen and to restore the flux in the yokes to the former value. These adjustments are made by means of an adjustable transformer *T* and suitable test coils in connection with a galvanometer. After these adjustments the flux in the rod is measured ballistically in the usual manner.

In this method the compensation for reluctance of the yokes is not complete, due to the fact that it is not distributed in proportion to the reluctance of the circuit; it is impossible to estimate the error thus introduced. Furthermore the adjustment depends upon the speed of reversal of the commutator. It is impossible to set the apparatus to predetermined values of *H* and *B*. It has the great advantage, however, of being applicable to a single rod.

Consider for a moment a long uniform rod surrounded by a uniformly-wound solenoid, carrying current. The rod is uniformly magnetized throughout its length. The condition for uniform flux is that the magnetizing force divided by the reluctance or H/R shall be constant. If, however, there is a portion of the rod which has a greater permeability or a greater section than the rest of the rod, the flux in this region

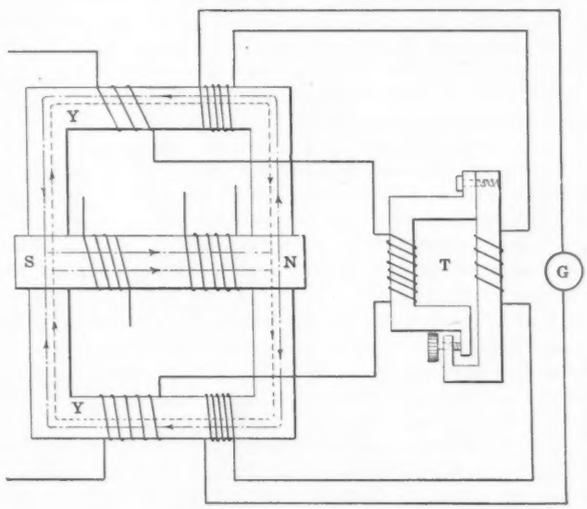


FIG. 2.—ESSENTIAL FEATURES OF PICOU PERMEAMETER.

will be greater because H/R is greater. The uniformity of flux may be restored by removing some of the magnetizing turns encircling this region. If at another point there is a region of greater reluctance, there will again be a non-uniformity of flux unless the magnetizing force over this region is increased. Thus a uniformity of flux may be secured in spite of inhomogeneities, provided the magnetizing force is so distributed that throughout the circuit H/R is constant.

Such inhomogeneities as these are found in the ordinary bar-and-yoke methods of magnetic measurement. The yoke usually

has a smaller reluctance than the bar while the joint connecting the two has a higher reluctance. Ordinarily there are no magnetizing turns over the yokes so that the magnetizing force, the reluctance and usually the flux have non-uniformities at the yokes. Properly distributed compensating turns may restore uniformity of flux. This is the basis of the method used in the magnetic measurements at the National Bureau of Standards. The author said that in the development of this method he had the co-operation and assistance of Prof. E. B. Rosa, who is in charge of the electrical and magnetic work of the bureau.

BUREAU OF STANDARDS METHOD.

From certain more or less obvious considerations it appears desirable to have the specimen long and slender, the yokes of the same cross-section as the test specimen, well surfaced joints, uniformly wound coils fitting closely over both yoke and specimen and an additional coil over the joint.

Owing to practical considerations, however, certain modifications must be made in the above ideal conditions. The magnetic circuit may be composed advantageously of two short yokes and two bars, one of which is the test specimen. The magnetomotive force is applied in three sections, one over the test specimen, one over the second or auxiliary rod, and the third distributed over the four joints. These are connected in series and the individual coils shunted so as to vary the relative magnetomotive forces developed. By means of suitable test coils distributed over various parts of the circuit, it is possible to adjust the three sections of magnetomotive force so that there is approximately uniform flux throughout the magnetic circuit. When this adjustment is made the corresponding values of B and H may be obtained from a test coil wound over the middle of the test specimen and from the concentration of magnetizing turns immediately over this test coil. In practice three test coils are used. One of these is placed over the middle of the test specimen; a second is divided into two sections and distributed over the ends of the test specimen. The third is over the middle of the auxiliary rod. If the auxiliary rod is of the same material as the test specimen, the time of a test is greatly reduced.

The flux is measured by connecting the test coil surrounding the specimen in opposition to the secondary of a variable mutual inductance and adjusting the currents in the primary of the mutual inductance until no deflection of the galvanometer is noted on reversal of the two primary currents.

The variable mutual inductance is of wide range and is adjusted for each specimen to such a value that the induction in the test specimen is given by the relation:

$B = 10{,}000\ I$, where I is the primary current.

In the adjustment of uniform flux and of the current in the variable inductance the ballistic throws are in each case due to the difference of two e.m.f.'s which is eventually reduced to zero. Consequently one may use the galvanometer at maximum sensibility and is not concerned with its constancy or calibration.

All current measurements are made with a potentiometer and resistance standards. The resistance standard used in the measurement of the magnetizing current is of such a value that the potentiometer reading differs from the magnetizing force by a power of 10. Thus the values of both the magnetizing force and the induction are read directly from the potentiometer with no further calculation than the shifting of a decimal point. By means of this apparatus it is possible to set to any predetermined value of induction or of magnetic force; this is a very decided advantage. In this third method it is possible to set limits to the possible error due to imperfect adjustment of the compensating magnetomotive forces, by comparing results with overcompensation with those with undercompensation. The error due to imperfect compensation is very small and may be reduced in proportion to the patience of the experimenter. In spite of the sources of error mentioned, the three methods give surprisingly consistent results.

METHOD OF PROCEDURE.

The flux in iron depends on the actual value of the magnetizing force, the previous magnetic condition and also the manner in which the magnetizing force is applied or altered. If consistent results are to be obtained by different methods the iron must receive the same magnetic treatment in each case. This is especially important when a standard permeameter rod measured by one of the absolute methods is to be used in the calibration of a commercial instrument.

Standard permeameter rods are measured at the National Bureau of Standards under the following conditions, which were selected after a large amount of experimental investigation. The specimen is clamped in the permeameter and carefully demagnetized by making one or two reversals per second of a magnetizing current which decreases slowly from an initial point well above the knee of the curve to a final value somewhat lower than the lowest value to be used in the test. After thoroughly demagnetizing in this way the smallest magnetizing force to be studied is applied and reversed many times till the iron is in a cyclic state. During this process the compensation for non-uniformity of flux is made. The number of reversals necessary to bring about a cyclic condition varies from a half dozen in the region of high inductions, to several hundred in the steepest part of the induction curve. In general, a soft steel is slower in reaching a cyclic state than a hard one. The induction resulting after this process is the quantity to be measured. For the highest accuracy it is necessary that the earth's field does not act longitudinally on the specimen, otherwise the lower inductions will be in error. It is further desirable that the apparatus be protected from mechanical vibration. Such vibrations cause a higher apparent induction than normal. In commercial instruments which measure the field due to the magnetized specimen care must be taken to eliminate the effect of the earth's field and of any strong magnets, particularly in measuring instruments, which may be nearby.

For a hysteresis curve the iron is caused to pass through the cycle several times by reversing the maximum magnetizing force. Then the current is reduced at one step to a smaller value and the corresponding induction determined. After this first point on the hysteresis loop is obtained the iron is carried through the original cycle several times as before and a new point determined. In this way as many points as desired are obtained. Negative values of H are obtained by reducing and reversing the magnetizing force at one operation. By this procedure each point is an independent determination, and is independent of any appreciable effect due to magnetic viscosity or to the number of steps.

Since a correction curve must be obtained for every hysteresis loop having a different maximum induction, it would seem very desirable to fix upon some one maximum value for a standard hysteresis loop. The hysteresis commission of the German Electrotechnical Society has suggested a maximum induction of 10,000 as a suitable standard value and this is the value which is in use at the Bureau.

THE TEST PIECE.

From the magnetic standpoint the test piece should be long and slender and so surfaced as to make a closely fitting joint with the yokes. Most apparatus call for a turned specimen. This means that great care must be exercised in having the test specimen and permeameter hole of exactly the correct size, and special bushings will be required if there is to be any variation from size. It is quite difficult to get bushings and specimens to fit perfectly. Any variation in the contact means a variation in the distribution of leakage at this point and a consequent variation in the correction factor. It is better to use a specimen of rectangular section as it is much easier to get a good contact between two flat surfaces. Furthermore slight variations in size do not impair the magnetic contact, and bushings are not necessary. Mechanically a long, slender rod is difficult to prepare, and a compromise might be made on a rod 35 cm long and of square cross-section 0.9525 cm on a side. This cross-section is chosen because it is a stock size (⅜ in.) and is the largest rectangular rod that will fit in the better permeameters already mentioned. It is a very satisfactory size both magnetically and mechanically.

Uniformity in the magnetic conditions under which the test

is made is absolutely necessary if the data of different experimenters are to be comparable. For purposes of comparison also, prescribed limits for the hysteresis loop are desirable. A standard size and shape for the specimen would add nothing to the accuracy of the test, but would decrease the cost of test to a fraction of what it would be if the testing laboratory has to handle all sizes and shapes.

Water Power Development in the National Forests.

A paper which drew forth considerable discussion at the recent Atlantic City Convention of the American Institute of Electrical Engineers was one by Prof. Frank G. Baum on "Water Power Development in the National Forests; a Suggested Government Policy." This paper was briefly noted in our issue for July 4. Abstracts of the paper and discussion are given below.

The paper by Prof. Baum outlined a government policy with reference to water-power development, so arranged as to encourage the use of the energy of water power instead of coal. He suggested the making of a proper conservation charge, and granting of rights-of-way and lands necessary for development permanent on condition that a certain proportion of the work be done each year, and that a certain proportion of the work be completed within five years, at which time a patent for all grounds occupied should be granted. After discussing the subject in detail, the author concluded that a proper conservation charge can be made only on the basis of the cost to the government of that which is furnished by the government. The proceeds from any particular privilege cannot be devoted to any other watershed or any other section, or for any purpose except the particular privilege. The conservation charge should have a maximum limit at any given time which can be determined by calculating the yearly cost of the conservation to the government. This charge can be fixed for a period of, say, 10 years, and at the end of that time a re-calculation may be made, and a new conservation charge made yearly, to meet the changing cost of maintenance. The question of the proper conservation charge is entirely a separate matter from the charge to be made for lands and rights-of-way for development, and the two matters should be kept distinct. Rights-of-way and lands necessary for the development should be charged for on a fair basis of value, as would be determined if the lands belonged to private parties and a value had to be set on them by a court, or a commission. Rights-of-way and lands necessary should be deeded outright by the government to the company and the only changing conditions then, as time goes on, would be the yearly conservation charge.

The discussion of the paper was opened by Mr. John H. Finney, who claimed that Prof. Baum's presentation of the case is wrong from several standpoints, namely:

First, in considering the national forests, wherever located, in the light of a local asset and not as a national asset, in which all the people should share.

Second, in basing a power charge, or franchise, solely on the cost of forest conservation and not on the value of the grant fixed by the earning capacity.

Third, in the attitude that assumes that a policy other than that outlined by him would put a tax on discovery, invention and development, by ascribing to capital and genius seeking legitimate investment and fair returns, attributes that indicate a selfishness fortunately not always true.

Fourth, by a disregard of what might be termed the "rights of the people" in and to an asset of perpetual value, national and not local in character—a value that increases from decade to decade, as coal becomes scarcer and dearer.

Mr. Finney stated that a better plan is that followed by the Forestry Service, which is in accord with the opinions expressed by President Roosevelt before the recent Conference of Governors in Washington, namely:

(a) The charge for power permits should be based on the power value of the land occupied and the value of the services rendered by the Government.

(b) The proceeds from any particular permit may legally be appropriated by Congress for any public purpose and, under the same policy, may properly be used for the expense of administering in national forests or for the reclamation fund or for the proposed inland waterways fund.

(c) The plan of calculating the maximum conservation charge upon the yearly cost of forest conservation to the Government would be impracticable, for the additional reason that such cost ought to be vastly higher than it is now. In the European forests the cost is several dollars per acre as against one cent per acre this year in this country.

(d) The question of the charge for power plants is a unit In considering it, the rental value of the land and the value of the services rendered by the Government in forest conservation should and must be considered together.

(e) The rental value for power purposes of the lands occupied should be paid by the permittee, not merely their value for forest purposes, farm purposes and the like. The Government is entitled to their value for all purposes, especially including the purpose for which they are actually occupied. This value must be fixed by the administrative officers of the Government at such a rate as will encourage the taking of permits. However, the Government should retain permanent ownership, subject to the temporary right of the permittee to use the land.

(f) Practical considerations of administration make it desirable that the charge for power plants should be uniform. It has therefore been fixed at a rate which is believed to be sufficiently low not to check the development of any project.

Mr. Edward R. Taylor criticised the assumption by Prof. Baum that the granting of water power privileges and the preservation of forests are local problems, and suggested that each state or section should develop one or two streams completely with forests and lakes and put them to work earning money to develop others later.

Prof. J. P. Jackson expressed his agreement with the views presented by Mr. Finney, and stated that the Government should not give away the natural resources and water powers.

Mr. P. P. Wells, in explaining the attitude of the Forestry Service with regard to conservation, said that it does not favor the present system of having permits for water power development revocable at the discretion of the Secretary of the Interior, but it desires authority to issue permits which would be irrevocable except for breach of contract. At the present time permits are issued for a term of 40 years, the charge being specified in each case before development begins. As each license expires new conditions will be imposed in accordance with the changed circumstances. Pressure is put upon the permittee to make full use of the permit. The Forestry Service favors a uniform small charge and an annual rental based on the power development.

Mr. A. H. Babcock expressed the opinion that Prof. Baum had based his conclusions on the assumption that in the case of a water-power development of a district, the power must be developed within a limited area, and the people in this area must pay the charge that the Government imposes, and that therefore they are entitled to the benefits.

Mr. Wm. McClellan compared the conditions in localities where no development has taken place with those in places where there has been partial development. He said that the Government should take some of the profit from the greater places in the West and apply them to the South and East where partial developments and "spoiled" water powers are common.

Dr. Chas. P. Steinmetz stated that the method proposed by Prof. Baum for treating the development of a water-shed as a local matter would defeat the very object in view, namely, the preservation and protection of our national resources. Water power development is directly related to coal preservation which is recognized as a national, rather than a local matter. He agreed with Prof. Baum that a development charge at a fixed amount per kw is unfair for power developed near New York.

For example: is far more valuable than power at a great distance from a market. The lifetime of a franchise should be the lifetime of a generation, but at its termination there should be no confiscation; the plant should be preserved as a tangible asset of the investor.

Mr. Charles H. Porter, in a written communication, summarized the difference between Prof. Baum's views and his own by stating that whereas Prof. Baum believes that water power development should be encouraged as much as possible, while he holds that it should be encouraged only to such an extent as to insure development and that the public should not be compelled to pay for any unnecessary encouragement.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Light and Power at Amherst, Mass.

By William H. Stuart.

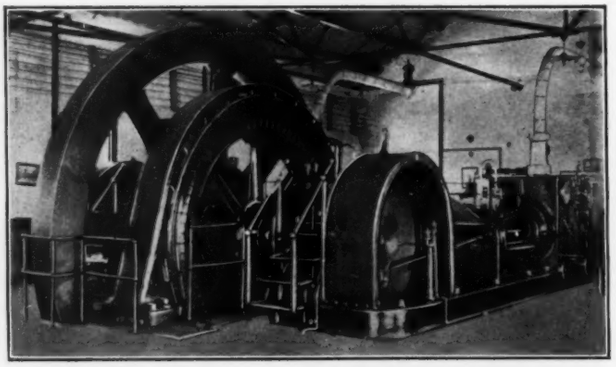
Amherst, Mass., is a small, typical New England town with a population of some 8300 inhabitants, and the center of a truck farming and tobacco raising section. In fact, the tobacco growing industry is fast crowding out garden products. Amherst has three principal manufacturing industries—the making of straw hats, pocketbooks and paper. It is also the seat of two colleges, Amherst College and the Massachusetts State College. Most of the town people are employed in the mills and in farming.

The first electric-light plant was started in Amherst in 1888, this being one of the many small plants built and operated by the Thomson-Houston Electric Company. After operation for about one year by the Thomson-Houston people, it was sold to the Amherst Gas Company in 1889. The equipment of the plant consisted of a 750-light generator and a Ball engine. The plant was located in a small wooden building on the west side of the town. During the year of its purchase the new owners moved the station to the east side of the town so as to have it near the gas works, where they erected a small brick building and installed a new Westinghouse engine. This plant, as erected, was used for about six years until, owing to additional business, it became overloaded and the question of additional generating machinery to take care of the increase of business came up. On going over the matter it was concluded that the coal and water facilities were not of the best, so that it was finally decided to build an up-to-date station, and a site was purchased at the head of Spalding Street which, being near the railroad, gave excellent coal and water facilities.

The present plant is located in a brick building, 108 ft. long by 47 ft. wide, and one story in height. It is divided into an engine and generator room, 70 ft. x 40 ft., and a boiler room, 35 ft. x 45 ft. In the latter are two Dillon horizontal tubular boilers of 125 hp each. The generating machinery consists of a 200-hp Corliss engine belted to a 150-kw, three-phase, 2200-110-volt General Electric generator; a Corliss 600-hp engine direct-connected to a 400-kw General Electric generator, three-phase, 2200-110 volts, and a 90-hp Harrisburg engine belted to a 60-kw, three-phase, 2200-110-volt generator. The engines and generators are placed at the northern end of the building and the switchboard at the opposite end. The switchboard is of dark slate and consists of nine panels, three machine panels, two incandescent-light panels, one arc-light panel, one power panel, one exciter panel and one regulator panel. The coal is brought in on a spur from the railroad and dumped into a large bin direct from the railroad cars, whence it is brought to the boilers by means of wheelbarrows. The boilers are hand fired. Pea coal was used up to last year, but the price became so high that soft coal has since been used. The ashes are given away and used for filling.

Distribution is by means of pole lines, Amherst as yet having no agitation, political or otherwise, toward requiring the placing of street mains underground. The transformers are all placed on poles and wherever possible are grouped, but few being used individually. The total length of wire on the pole lines is 477,000 ft., the number of poles being 693. The number of enclosed arc lamps connected is 56. The number of public lamps in use is 153 25-cp incandescent lamps at $16.50 per lamp per year, and 32 arc lamps at $70 per lamp per year. The city arc lamps burn until 12 o'clock every night. There are 124 hp in motors connected. The largest single motor is a 50-hp machine, which drives two paper beaters in paper mills. Most of the power required by the different mills in the town is furnished by the company. The total amount of energy generated last year was 231,957 kw-hours.

The meter department is located at the station. When a meter is received from the makers it is tested, given a number and placed in stock. When a meter is sent out to be placed in circuit, a meter-record card is filled out in full and placed in the card file. All changes, tests, adjustments and repairs are noted on these cards under their respective dates. On the reverse side of the card is a record of the different regular and special tests the meter undergoes during its life. Each meter is tested yearly. When a consumer complains of high bills and requests that the meter be tested, it is replaced by another and the questionable one brought to the station for testing. If found to be in good condition and to register correctly, it is placed in stock again and the consumer informed as to the result of the test. If the meter was at fault and fast, a proper credit is made on the consumer's bill. A transformer card is used for the keeping of a record of the different tests made on transformers.



ONE OF THE GENERATING UNITS, AMHERST STATION.

The offices of the company are located in the center of the city, on the first floor of the Town Hall, where very attractive headquarters are maintained. The consumers' ledgers are of the loose-leaf type.

There has been considerable active soliciting done for new business by Mr. David Barry, the electrical superintendent, while the officers and employees have always been on the outlook, and any prospects reported by them have been followed up. Every house, store, factory and property in the territory has been visited and a record made and kept on file of the lighting and power conditions as found, with a note of the prospects for the introduction of electric service. No regular solicitor has ever been employed by the company, and this record and personal knowledge by the superintendent of every person in the town has helped to get the new-business work systematized.

Various appliances have been taken up as a means of obtaining a day load and also to serve to introduce electric service. About 125 flatirons were put out on trial and every one was sold. Small heating pads and curling irons were also put out where

it was possible to do so. A sharp lookout is kept on all new arrivals and on building operations.

The methods used for advertising were, at first, the writing of personal letters to different people of standing in the town. These were sent out from time to time where there was some prospect of business. Replies, as a rule, were received. Next, circulars were sent out with the monthly bills, illustrated with cuts of the various electrical appliances and methods of using the service, noting especially the particular advantages. Circulars received from the manufacturers of various appliances were also included with the bills. An advertisement was run each week in the local newspaper, with cuts of the flatiron, sewing-machine motor, heating pads, etc. Everything was done to keep constantly before the people electricity with its advantages.

The commercial rate for arc and incandescent current is 16 cents per kw-hour, with a 10 per cent discount. The residential lighting is done at the rate of 20 cents per kw-hour, with no discounts. There is a minimum monthly charge of $1 for each installation. Lamp renewals are furnished at 20 cents each. The power rate is 10 cents per kw-hour, with discounts based on consumption, which causes the prices to range from 8 cents for 200 kw-hours to 5 cents for 1000 kw-hours and 33 cents for 7000 kw-hours, monthly. The minimum monthly charge is based on the size of the motor. For 1 hp or less the charge is $2.50 per month; 2 to 5 hp, $1.50 per horse-power per month; 5 to 10 hp, $1.25 per horse-power per month; 10 hp or over, $1 per horse-power per month.

During 1906 the company asked permission of the Board of Gas and Electric Light Commissioners of Massachusetts for authority to supply electricity in the adjacent town of Pelham, which was granted with the understanding that the amount of current supplied must not be less than 50 kw.

Mr. David Barry, the superintendent, in speaking of the company's business and field, said: "Amherst is a typical country town with the addition of the two colleges. Being the home of a great many shop hands, the field for the introduction of electric service is narrow. Of course, our work has been similar to that of the other small New England towns—we have got to get power business to offset the lack of residential and store lighting. In a small town, such as Amherst, we know everybody and every one knows us. We are able to see at a glance just what our prospects are. We have the obstacle to overcome of scattered territory, especially in the residential section. Where ordinarily it would take but one circuit to reach a few customers, it takes here a considerable number. If we could get the prospects to stand some share of the expense of reaching them it would not be so bad. We have succeeded in building up a good, steady average load. We have never tried any of the sensational 'new-business' ideas, as we believe our field is a little too conservative for such methods. We have gained good headway by quiet, persistent work. Once we locate a prospect everything is done to secure the business. Our advertising is more for the purpose of keeping the company always before the people than for what business it brings directly. Our office is small, but we are centrally located and when people come to the Town Hall on business or pleasure, our office is in full view. Our business has increased each year satisfactorily."

The officials of the Amherst Gas Company are: Mr. E. D. Marsh, president; Mr. C. Fred. Deuel, secretary and treasurer; Mr. David Barry, manager and chief electrician.

Loaning Show Windows.

A plan which has been employed by an enterprising gas company in the central states to stir up interest in show window lighting can well be copied by electric light companies. The gas company has a show window which it places in turn at the disposal of various merchants in the town who are not doing show window lighting. The company loans this window for the display of a merchant's goods for a certain period of time in order to demonstrate to the merchant the advantages of this kind of advertising, and also to create a friendly feeling among the merchants.

Ornamental Street Lighting in Minneapolis.

BY R. H. MCGRATH.

The evening of June 20, 1908, is one long to be remembered by the citizens of Minneapolis. It marks a date—the commencement of electrification of Minneapolis. The event was the turning on of the initial installation of an ornamental street lighting system, which bids fair to excel anything in the country. As the chimes on the City Hall struck 8:30, the 320 lights were switched on simultaneously, the bands played and the shouts of 25,000 people, gathered especially to witness the sight, filled the air. For one hour this main street of the city, Nicollet Avenue, was cleared of all vehicles in order that the best possible opportunity to see the effect might be presented. All were much delighted and agreeably surprised at the result, and nothing but very favorable comment was heard throughout the evening. This event was the first of its nature ever undertaken by a private organization—such matters are usually handled either under the guidance of the common council or a public service corporation; in this instance, however, the credit of success must be given to the Publicity Club, whose

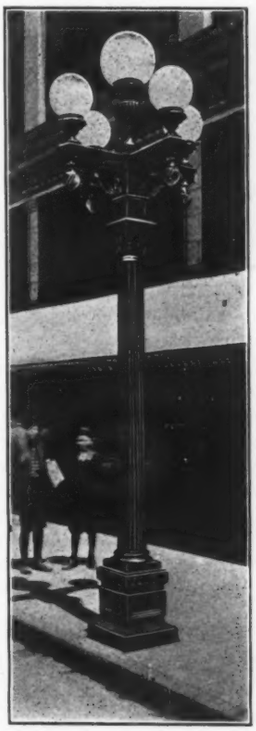


FIG. I.—THE MINNEAPOLIS POST.

lighting committee went among the merchants, showing them the benefits to be derived from this form of street lighting. Already the motto that "Trade follows light" has aroused the enthusiasm of these merchants on the streets where the new street lighting has not yet been installed.

The initial installation of these posts on Nicollet Avenue consists of 64 standards placed eight to a block, four on either side of the street, so arranged that when the side streets are connected up a uniform spacing of 100 ft. between posts will be sustained. This, however, is but the forerunner of an ultimate installation aggregating in a few years three or four hundred standards.

The posts (see Fig. 1) are of cast-iron, standing 14 ft. above the ground, are artistically ornamental so as to present a neat appearance by day as well as by night, and when the lights are switched on produce a very beautiful effect. The posts are 2 ft. higher and the arms 2 in. longer than those at St. Paul, which have been illustrated in the ELECTRICAL WORLD of March 2, 1907. On the tops of the posts the four

arms support the 12-in., round, light alabaster globes, one on the end of each arm. Each globe contains one 100-watt General Electric tungsten lamp in an upright position. These lamps have been run on life tests in this position, and there was practically no difference in the life of the lamps, whether in an upright or pendant position, as long as the lamp was perfectly vertical.

The advantages of the globes in the upright position are: (1) A minimum breakage. (2) Greater cleanliness. (3) Greater lighting area.

In the top of the post itself is a 16-in. globe similar to the others, which also contains one 100-watt tungsten lamp, making

FIG. 2.—NICOLLET AVENUE, MINNEAPOLIS, BY DAY.

a total wattage per post of 500, as compared with 811 at St. Paul, and yet the lighted area per post in Minneapolis will be much greater than at St. Paul. It is also interesting to note that a similar system of street lighting at present used by a commercial house has a wattage of 1600, and when compared with the new tungsten installation of 500 watts, looks yellow and its radius of illumination is much smaller. These posts are connected to the Edison three-wire direct current 110-volt underground system by lead-sheathed cable. The underground system covers the entire congested business section of the city.

The initial cost of these posts installed in Minneapolis is to be $145 per post. Of this amount $85 is for foundry work and $60 for the wiring, globes, lamps, etc. The Minneapolis General Electric Company is to have charge of the maintenance and furnish service at $78 per post per year. The maintenance expense will cover renewal of tungsten lamps, renewal of broken globes, washing of globes and painting of posts.

All five lamps on each post will be switched on at dusk from an electrolier key switch at the base of the post. The four lamps on the arms will be turned off at midnight, leaving the

FIG. 3.—VIEW DOWN NICOLLET AVENUE, MINNEAPOLIS, BY NIGHT.

pilot light on the top of the post burning until daylight. At the present time these lights are turned on by the flat rate switchmen, who turn on other flat rate lighting for the company. Eventually, some method of station control will be installed.

The cost of first installation and of operating is met by assessing merchants $2 a front foot to cover installation, and $1.25 a year per front foot for maintenance.

This system is unquestionably the greatest means of advertising a city and of directly advertising its merchants, and from a central station standpoint its advantages cannot be denied. Fig. 2 is from a day photograph of the street, and Fig. 3 is from a night photograph.

Boston Edison Rates in Winchester Considered by Massachusetts Commission.

The Massachusetts Gas and Electric Light Commission has issued an order declining to make a final decision on the complaint of the selectmen of the town of Winchester, Mass., that the rate charged by the Edison Electric Illuminating Company, of Boston, in that town are excessive, unfair, unreasonable and discriminating, and that the lights are not of the kind and standard required by the town. The board states that no evidence has been produced to show that the lights are below the standard, and that this part of the complaint was expressly waived. The town and the company have been unable to agree on a contract since the end of June, 1907.

The company contracted with the neighboring town of Arlington to furnish the same quantity and size of lamps at the rate paid by Winchester, but with 20 per cent discount on each monthly bill for a 20-year contract. The town of Winchester claims that it is entitled to a single-year contract on as favorable a basis as Arlington's long-time agreement.

It was contended by counsel for the Boston Edison Company that the possibility that a town might light its own streets and abandon the company's supply introduced a large risk of abnormal depreciation into single-year contracts, and that the company is justified in making special reductions to municipalities making long contracts. The board rules that it has no authority to order a reduction of price conditional upon the town's making with the company a long-term contract or any express contract for the supply of its street lights. It states that the company is bound to serve the town and the town bound to pay the company no more than a reasonable compensation for the service rendered. Even if the question here were the fairness of the rate for a 20-year contract, the board has no authority to make an order relative to the terms of such a contract. If the customer has seen fit to make such a contract, he has no occasion to ask a public board to interfere in his behalf. The board states that it is its duty in fixing the rate at which the company is bound to serve all, to see to it that no improvident contracts made by the company with certain customers (whether under published schedules or not) impose any burden upon customers who require the company to perform its duty to serve all. The board believes that the interests of both parties and perhaps of other municipalities besides Winchester require that a final decision shall not be made without further investigation, and offers to reopen the case if the town desires an opinion as to a fair price for street lighting, investigated on its merits.

Street Lighting Bids Submitted in Boston.

Offers have been received by Superintendent of Streets Emerson, of Boston, from the Cleveland Street Lighting Company, the Rising Sun Street Lighting Company, the Sunlight Illuminating Company and the Edison Electric Illuminating Company of Boston for the lighting of the streets, parks and alleyways. The Edison company did not submit a formal bid, but offered to light the city's minor streets, etc., with tungsten electric lamps of 40 cp for $20.37 for one year, or $19.35 per lamp per year for five years; and 60-cp tungsten lamps for $23.49 for one year, or $22.32 a year for a five-year contract. The other bids were as follows:

	Price per lamp per year			
			Sunlight Co.	
	Cleveland.	Rising Sun.	Gas.	Gasoline.
Single gas incan. burner	$24.90	$25.20	$27.00	$17.40
Single gasoline or naphtha inc.	30.25	29.20	28.00	....
Lantern, 2 inc. burners	37.60	36.80	54.00	34.80
Above, 3 burners	51.20	49.20	60.80	36.00
Cluster, 2 lanterns, 1 gas	47.50	48.00	54.00	34.80
Cluster, 2 lanterns, 2 gas inc. burners	73.20	71.60	107.00	68.60
Cluster, 3 lanterns, 1 gas inc. burner	68.00	69.00	81.00	52.50
Cluster, 3 lanterns, 2 gas inc. burners	105.40	106.80	160.00	102.40

Superintendent Emerson took the bids under advisement. This work is independent of the arc-lighting contract of the city with the Boston Edison Company.

Special House Wiring Offer.

The Rockford Electric Company has recently reopened for 30 days a special house wiring offer. This offer can best be explained by reproducing here an advertisement which appeared in the electric issue of a Rockford daily paper. The company furnishes the fixtures and wiring, the fixtures being designed in accordance with illuminating engineering principles, so that the company will have a minimum number of complaints from poor illumination.

IN VIEW OF THE GREAT SUCCESS

Of our Former Offer, we Renew our House-Wiring Proposition for 30 Days

We Will Equip Your House for ELECTRICITY In the Following Rooms:

One 1-light Fixture in Reception Room, with Switch
One 3-light Fixture in Living Room
One 2-light Fixture in Dining Room
One 1-light Fixture in Kitchen
One Plug for Electric Iron in Kitchen
One 1-light Fixture in one Bedroom
One 1-light Fixture in Bathroom

ALL COMPLETE, READY TO LIGHT, FOR

$44.00

This offer is open until July 31st, to anyone living near our lines.

To Each of the First 50 Persons Placing their Order we will Present an ELECTRIC FLAT-IRON

BETTER BE ONE OF THEM

ROCKFORD ELECTRIC CO.

SPECIAL HOUSE WIRING OFFER.

INTERIOR WIRING AND ILLUMINATION

Means of Increasing Contracting Business.

BY LOUIS J. AUERBACHER.

The various sales methods of the up-to-date contractor cover a wide range. In large cities where the chances for possible customers and renewals are promising and large, the contractor who desires to expand his business properly must be on the alert and use every legitimate means to secure trade. The best salesman is a satisfied customer, and in all electrical work a good job is a business getter. The average customer would rather pay a trifle more if thereby he could be assured of a satisfactory installation. A few dollars saved with the prospects of having trouble with motor, lamp, telephone or bell circuits at critical times does not appeal to him. If he has been given satisfactory service he is almost certain to stick to the contractor unless the latter becomes careless and "sticks" him. Contractors very often make the mistake of banking on the confidence of a good customer and charging a little more for work than would be the case if the customer were watching carefully. Such methods do not pay in the long run and if the work is charged for at rates consistent with the character of the work, the industry gains as well as the customer.

In private house work the foreman or wireman on the job oftentimes makes a good salesman. The casual recommendation of a wireman will do more to induce the customer to install an additional outlet, receptacle, switch or new device than all the eloquent pleading of a salesman. When a wireman receives such an order, the switch or outlet should be located at once since a hole in the wall for the box is usually sufficient to guard against any countermanding of the order due to a change of mind on the part of the mistress of the house.

A uniform set of prices for outlets, switches or receptacles should be maintained so that the wireman can give the cost of the required new work approximately, without waiting to make inquiries at the office or otherwise delay beyond the proper moment in securing the order. If some runs are longer than others, the price should be such as to allow for the average length. In searching for new business, the contractor should not neglect the opportunities presented in the real estate news. Every purchaser of a house or builder should be canvassed just as soon as the fact becomes known, and many new customers can be secured in this way. When orders for such work are received the contractor should start the job at once before competitors approach the owner with other propositions and lower prices.

On contract work for builders and architects, the original job seldom allows of very great profits. The latter are made on extras, and after the owner has taken over the house a salesman should call to see if changes or additions are required. Oftentimes after an owner occupies a house, many conveniences not at first thought of are desired and this work should fall legitimately to the contractor who made the original installation. In loft building work a list of tenants with their lines of business should be secured and an endeavor made to interest them in electrical fittings which will best suit their needs.

In certain seasons of the year many removal notices appear. If a salesman would look after these concerns and ascertain where they intend to move and who is to take the space in the old building, much work can be secured. The trade journals should be followed carefully for descriptions of new devices. Nothing interests a man so quickly as some new and ingenious device and some big accounts are often opened in this way, the customer becoming interested in some new device which appeals to his wants. As a rule such sales of new apparatus are quite profitable.

In order to follow up prospective customers properly, the contractor should provide himself with a good card index upon which proper notes may be placed from time to time. If after bidding on an installation the contract is given to another, the contractor should endeavor to find out why the contract was lost so that in bidding on future work mistakes previously made may be avoided. Old customers should be looked after from time to time. If no new work has been done for a customer in some time, a call should be made. As an excuse some new device may be brought to his attention. If new work is given to another because of some real or fancied grievance, this fact can be thus ascertained and if possible the good will of the customer again obtained. The contractor should never lose sight of the fact at any time that good, honest work always pays and is worth more than a dozen salesmen.

Tungsten Lamp Fixtures at Wabash, Ind

Mr. T. W. MacNamee, manager of the Wabash (Ind.) Water & Light Company, has been introducing tungsten lamps extensively among his customers. For some installations simple, inexpensive two- and four-arm fixtures having lamps pendant and Holophane bowl reflectors have been used. In other cases a simple hemisphere fixture is being introduced of the kind shown in Fig. 1. This consists of a 10-in. Holophane hemisphere covered with a reflector which carries a 100-watt tungsten lamp. The hemisphere is suspended with three chains.

The lamp and reflector are supported by a central arm. When placed high up near the ceiling, however, the central stem is hardly noticeable, nor is the socket and reflector. The main thing visible is the hemisphere and chain suspension. This fixture has an advantage over a hemisphere placed at the ceiling and used with a reflector in that a very wide metal spinning is necessary for holding the hemisphere when it is placed against the ceiling and a single tungsten lamp pointed downward is used within it, and this spinning looks rather heavy. The

TUNGSTEN LAMP FIXTURE.

hemisphere with its large surface diffuses the light better than the frosted tip of the lamp bulb. The light from a lamp of a given candle-power in a hemisphere is, therefore, easier on the eyes than if it came from the lamp in an open reflector. At the same time, the absorption or loss of light in a hemisphere of this type is very low. The fixture shown was made by the Bauer Gas Fixture Works, of Philadelphia.

Improved Terminal Lugs and Connectors.

By T. C. Lerret.

In these progressive days the electrician can, almost invariably, purchase terminal lugs and connectors from a regular supply dealer cheaper than he can make them for himself. But frequently, in cases of emergency, he must make his own. The suggestions herein outlined may prove helpful in such instances.

Fig. 1 illustrates a simple process by which rugged, useful terminals of the form shown at *E*, Fig. 1, may be made from ordinary brass or copper tubing, which can be secured in almost any town either at a plumber's or about the boiler house of some steam-power plant. A piece of tubing *A*, Fig. 1, is selected, having an internal diameter sufficiently great to admit the conductor for which it is to form a terminal. The length of the piece required is determined by conditions and experience. It is usually sufficient and in accordance with good practice so to cut the raw stock that the depth of hole *d* in the completed lug *E* will be twice the diameter of the hole *a*. The diameter *c* should be such that the current density through the plane of contact will not exceed in round numbers 100 amp per square inch. To provide against excessive heating the area of the cross-section at *b b* should be such that, for copper, the current density will not exceed 800 amp per square inch. If brass tubing is used the current density should be much lower. Inasmuch as the conductivity of brass is frequently only one-sixth that of copper the current density where brass is used should be about 130 amp per square inch. Obviously copper is the much more desirable material where large currents are involved. In reckoning the area of contact in order to determine the diameter *c*, the area of the hole *e* should be subtracted and the net area only considered.

The price of tubing *A* may be beaten into the finished form, shown at *E*, as follows: If appearance is not a great factor, one end of the tube may be beaten flat with a hammer, a hole drilled through it, the surface that is to be in contact finished off with a file, and the terminal lug is finished. If, however, it

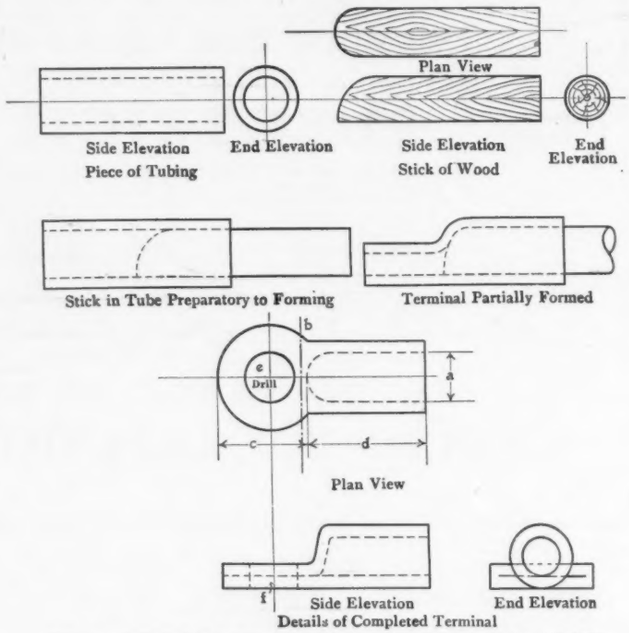


FIG. 1.—TERMINAL LUGS MADE FROM COPPER OR BRASS TUBING.

be essential that the lug look well, a piece of wood shaped as shown at *B* should be made. This is inserted in the tube, as shown at *C*. The tube is then formed around it by pounding, first, into the shape indicated at *D* and finally into the form illustrated by *E*. It is possible to make a far better appearing job with the stick than without it. After being shaped into final pattern, the lug should be neatly finished off with a fine file. Particular care should be taken that the surface *f* (*E*), Fig. 1, is absolutely smooth and plane so that it will provide good contact.

A wooden mallet can be utilized in beating the tube into form. This tool will not mar the surface of the metal. The peen end of a machinist's hammer will be required for pounding into the

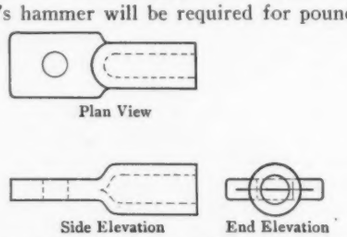


FIG. 2.—TERMINAL LUG MADE FROM TUBING.

rounding crevices. If copper or brass be worked beyond a certain point it becomes hard and brittle. It can be annealed by heating to a red color and cooling quickly in water. It will probably not be found necessary to anneal small terminal lugs in the making, but may be in the case of the larger ones. There is no difficulty in ascertaining when the metal should be softened, as it should be annealed as soon as it does not form readily under blows of the hammer.

Fig. 2 shows another form of terminal lug. It is easier to make this than that shown in Fig. 1, and it will answer admirably in many instances. All of the directions as to manufacture outlined in connection with the lug shown in Fig. 1 should be followed when making this lug.

The construction of a cable tap or branch connector is shown in Fig. 3. The entire appliance, with the exception of the bolts, which are of wrought iron, should be made of brass or copper.

It can be made from bar stock, purchasable from machinists' supply dealers. The size of the stock used will depend upon the diameters of the conductors involved.

In general, the thickness t of the block should be such that e, Fig. 3, will be about $\frac{1}{4}$ d. On this basis $t = 1\frac{1}{2}$ d. The width w may be equal to $2t$. The length of l of the small blocks should be

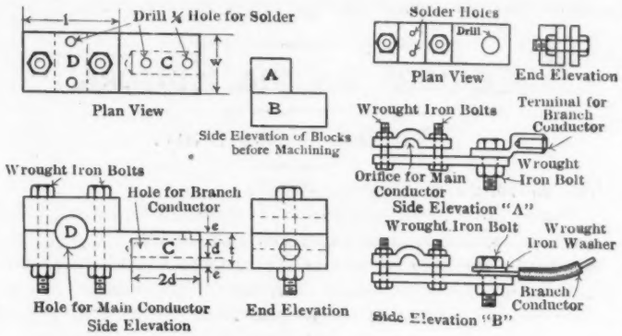


FIG. 3.—DETAILS OF BRANCH CONNECTOR.

FIG. 6.—EMERGENCY BRANCH TAP.

sufficient to accommodate the main conductor and allow room for the wrought-iron bolts. The consideration in regard to cross-sectional current density, referred to in connection with Fig. 1, should be checked in case brass is used. If copper is the material, the proportions given above will be more than sufficiently generous.

Inasmuch as it is always advisable to solder this type of connector to both the main and the branch conductors, it is not necessary to consider the current density at places of contact. The wrought-iron bolts are used merely to hold the connector in place while it is being soldered to the main conductor and, although they are left in position after soldering, the solder only should be relied upon to furnish contact. The diameter of the hole D should be such that the main conductor will slide through it easily.

From the bar stock two blocks A and B, Fig. 3, are cut. The hole c for the branch conductor and the holes for the wrought-

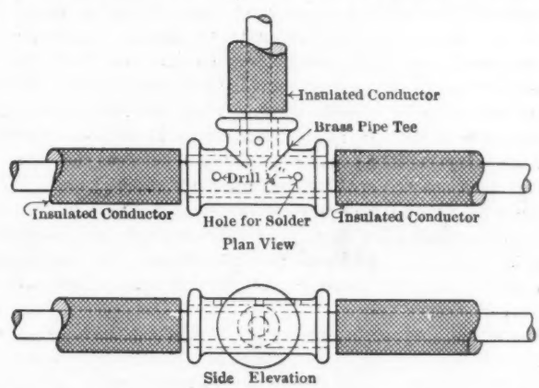


FIG. 4.—APPLICATION OF BRASS PIPE TEE AS A BRANCH CONNECTOR.

iron bolts are drilled. Then the blocks are bolted firmly together and the hole D for the main conductor is drilled, the two bolts holding the blocks rigidly together during the drilling process. Holes, $\frac{3}{4}$ in. in diameter, are made at the points indicated, through which solder, in the form of wire, may be fed after the manner to be described in connection with Figs. 4 and 5. The inner surfaces of the holes D and C should be tinned in the shop to facilitate soldering. This type of connector is sturdy, of neat appearance and has given excellent satisfaction whenever used.

Brass pipe ties can be utilized as branch connectors in cases where, as frequently occurs, a branch conductor is to be taken off at the point of junction of two main conductors. (See Fig. 4.) Solder is used to provide electrical connection, the entire space between the inner walls of the tee and the conductors being filled with it. The tee acts merely as a container to keep the solder where it belongs and to provide mechanical strength at what would otherwise be a weak point.

In using a tee for a branch connector the procedure is as follows: Drill in it the ¼-in. holes for solder as indicated and tin, with solder, the inner surfaces of the fitting. This operation is best performed by dipping the fitting in soldering acid to cleanse it and then dropping it in a pot of hot solder. After being removed from the molten solder it should be thoroughly washed in running water to remove all traces of the acid. If a solder pot is not available, the tinning may be performed by the patient application of stick solder flux, solder wire and the flame from a blow torch.

After tinning, the tee is placed in position, with the conductors in their proper places in it, as indicated in Fig. 4. Friction tape is wrapped about the ends of the tee, as shown in Fig. 5, and the flame from a blow torch applied until the fitting becomes hot enough to melt the solder. Solder wire is fed into one of the ¼-in. holes until it rises in the other two, an indication that all voids are completely filled with solder. The thoroughly cleaned ends of the copper conductors are, of course, tinned before insertion into the fitting. Some difficulty may be experienced from the friction tape catching fire. To provide for such an event a wad of wet waste and a can of water should be kept at hand, and if the tape shows indications of becoming ignited the wet waste may be applied.

In locations where appearance is not a factor, a galvanized-iron tee may be used instead of brass. Inasmuch as the tee itself does not necessarily carry current, it really is but a mechanical container for the solder, which conducts the electricity, the galvanized iron readily fulfills all functions.

Occasionally it is necessary to rig up quickly branch connectors, that are to serve but temporarily as, for instance, during the test of an electrical machine. The type shown in Fig. 6 meets such requirements admirably. Unless a very large cur-

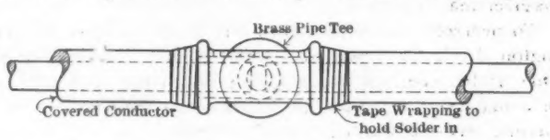


FIG. 5.—APPLICATION OF FRICTION TAPE WRAPPING TO KEEP SOLDER IN PLACE.

rent is to be carried it will usually be found sufficient merely to clamp the connector about the main conductor. The branch conductor may be sweated into a terminal lug, which is bolted to the connector shown at A, Fig. 6, or it can be bent simply around a bolt, under a washer, as shown at B. From the foregoing descriptions the method of construction of this type will be readily understood. If desired, this style of branch tap can be soldered to the main conductor by the use of tape and solder wire as outlined in connection with Figs. 4 and 5. Solder holes are shown in the illustration. Copper or brass is the best material from which to form this clamp, but wrought iron will be found to give entire satisfaction, provided its proportions are made sufficiently generous to obviate trouble from overheating.

New Telephone Patents.

SWITCHBOARD CIRCUIT.

Probably the most generally used three-wire multiple common-battery switchboard is that standard with the Bell companies. In this switchboard jacks all have three parts, tip, ring and sleeve. The sleeve circuit is led through a cut-off relay, in a manner to operate it upon the insertion of a plug. This relay controls the connection of the line-relay circuit with the line. In operating it breaks two contacts, leaving the line signal circuits open and inert.

In a modification of this circuit, patented by H. P. Claussen, the cut-off relay not only breaks two contacts, but in addition makes two. The line is connected to the swinging contacts, the line signal circuit to the back contacts and the jack tip and ring

to the front contacts. The jack springs are thus disconnected until the cut-off relay operates. It is difficult to see what is accomplished by this modification save the introduction of two unnecessary contacts in the talking circuit. This patent is assigned to the American Electric Telephone Company.

TRANSMISSION CIRCUIT.

A capacity transmission circuit forms the subject of a patent granted to I. Kitsee, of Philadelphia. The line consists of a twisted pair of wires terminating at both ends in a coil of similar wire, the ends standing open. All stations are cut-in in series in one of the two conductors, the second conductor being left continuous and insulated. Transmission is effected through the mutual electrostatic capacity of the conductors.

BELL MUFFLER.

Mr. G. S. Knowles, of Buffalo, Mo., has patented a bell muffler and primary cut-out for use with farmer-line sets. The muffler consists of a metal slide, which, in its normal position, in one of its functions, permits the bell-clapper to have free movement, and, in its other function, maintains the local transmitter battery circuit closed. In its other position a slot in the slide spans the bell-clapper so as to hold it in mid-position, and, at the same time, the movement of the slide to this position opens the circuit of the transmitter battery set. It is thought by the inventor that the use of such a device will effect a great saving in batteries, as when a subscriber is merely listening in his bell will be muffled.

RECEIVER FOR SERIES CIRCUITS.

With the simplest form of common battery station circuit, both the receiver and transmitter are included in the main circuit, it being necessary for the transmitter current to pass through the receiver. If this current oppose the magnetic effect of the polarizing magnet the receiver is weakened, and if it assist and its effect be considerable the diaphragm of the receiver may be buckled.

To overcome these difficulties, Mr. E. E. Clement, of Washington, D. C., has invented a receiver with a double winding. One of the windings has a higher impedance than the other, or it may have an impedance coil in series with it, but the two circuits have substantially equal effective turns and resistance so as to neutralize each other when connected differentially.

It will be understood that substantially all of the voice currents pass through the low impedance circuit and become effective upon it, while the steady flow from the battery has no effect.

RECEIVER SUPPORT.

A receiver support forms the subject of a patent granted to M. Waters, of New Albany, Ind. The support consists of a jointed bar, pivoted below the receiver hook and carrying at its end a receiver-holding clamp. The bar normally stands at an angle, holding the receiver a few inches out in front of the transmitter mouthpiece. The tendency of the bar to fall is restrained by a hook caught upon the receiver hook lever. This latter is thus held down except while the instrument is in use.

COIL FOR COMPOSITE SETS.

With composite sets wherein the same wire is used simultaneously to transmit both telephone and telegraph messages there is always the problem of the positive separation of the two classes of signals so that neither disturbs the other. It is very easy to eliminate the effect of the telephone current upon the telegraph, but the reciprocal is not so readily accomplished. It is with a view to bettering this separation that Mr. C. Duo, of Argentine Republic, has invented a special form of repeating coil. This coil carries six windings, laid one upon the other. The innermost and outermost windings are connected together differentially and are included in the line. The two layers immediately outside the innermost layer are connected together cumulative, as are also the two windings just within the uppermost winding. These two sets of cumulative windings are then connected together differentially, the telephone being included in the circuit. The scheme of operation is as follows:

The comparatively steady telegraph currents in the main line have practically no effect upon the secondary circuit because of the differential electromagnetic effect of the two windings included in the main line circuit. On the other hand, the rapidly varying telephone currents produce by induction a corresponding current in the secondary circuit because the windings of the coil are not sufficiently intimately associated to produce a differential effect with this type of varying current.

Letters to the Editors.

Wireless Telegraphy.

To the Editors of Electrical World:

Sirs:—Your editorial entitled "The Missed Opportunity" in the June 20 issue is most timely and illuminating. As a former worker in the field of wireless telegraphy, and an occasional contributor to the periodical literature of the subject, I have observed with regret the actual features of the art, that you so ably summarized, viz., the persistent limitation of wireless to non-important uses, and absence of concerted effort to work it for all it is worth; the long delay in the doldrums of the stock-selling stage, and the perennial joke of commercially practicable syntony, notwithstanding the good work that has been done by some of the inventors of so-called "tuned systems."

In this letter it is not my purpose to write anything that might read like another editorial on the subject; if I wished to do so, I could hardly add anything to the comprehensive and judicial review in the editorial referred to. But I take this way of heartily endorsing the editorial, and of expressing the hope that the comment and suggestions therein may do much not only to clear away the mists of misconception in the public mind, but also to help wireless telegraphy to the full possession of its rightful field.

New York, N. Y. Joseph B. Baker.

Classification of Accounts.

To the Editors of Electrical World:

Sirs:—Some confusion seems to have arisen in regard to a uniform classification of accounts for electric companies, due to the number of such classifications which have been put forward and to the consequent trouble in determining at all times which one is under consideration. A classification was adopted at the convention of the National Electric Light Association held at Niagara Falls in 1901, which, I believe, was the first one to be approved by the national association. This classification was revised and the revision was adopted at the convention in 1905. In 1907 a further revised and elaborated classification was submitted but not adopted. At the convention this year still another classification was submitted and approved.

In writing and speaking on this subject a number of the representatives of the companies have stated that they were using the system adopted by the national association several years ago, without stating definitely which classification they meant. This statement was understood in some quarters to refer to the 1905 classification, but on investigation I find that it really referred to the 1901 classification.

This 1901 classification seems to have been adopted by a great many companies throughout the country as a basis of their accounting systems. In some cases it is used exactly as submitted at the convention and in others slight changes have been made to meet the local conditions. As secretary of the Empire State Gas & Electric Association I have heard several estimates as to the extent to which this classification is now in use, and these estimates have ranged all the way from 50 to 85 per cent of all the companies in the United States. It would be very interesting to know what the exact percentage is, both of the companies operating in States where a commission exists and of the companies operating throughout the entire country.

New York City. Charles H. B. Chapin.

Production of E.m.f. in Revolving Armatures.

To the Editors of Electrical World:

SIRS:—In reply to the letter of Mr. James Gibbons in your issue for June 13, I wish to call attention to the fact that in my letter published in your issue for May 30 it was assumed that there is no flux through armature slots, although it is well known that flux does exist in the slots as well as in the armature teeth. This assumption, which was made merely for the sake of simplicity, has no effect upon the accuracy of the argument used by me.

It is to be noted that the argument adopted by Mr. Gibbons would lead one to assign to the e.m.f. a value much smaller than that actually found to be generated. For example: if 20 per cent of the total flux is assumed to pass through the slot, then according to Mr. Gibbons' argument the e.m.f. generated would be 20 per cent of what would be produced if the conductor cut the whole flux. Mr. Gibbons seems to believe that the same number of lines of force which pass through the leading tooth at the moment of starting to revolve would transfer to the next tooth across the slot. However, he states that the reluctance of the path through the tooth increases until it "becomes greater than that through the slot" and then the flux will cut through the slot. If such were true, the number of lines of force would decrease as the reluctance increases, because the m.m.f. produced by the field current may be assumed to be constant.

It seems to me that an explanation of the known facts can be obtained on the basis of an arbitrary hypothesis as to the manner of creation and destruction of flux, as is done in the case of stationary transformers. As is true with the transformer phenomena, the production of e.m.f. in the conductors in slots in a revolving armature can be explained by assuming that the creation of flux in a certain place is not spontaneous, but that the flux comes to that place from an infinite distance, while the destruction of flux involves the reverse operation.

ITHACA, N. Y. S. SANO.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Commutation.—H. POINCARE.—A brief mathematical paper on a paradox in the theory of commutation which is explained by taking into account the small capacity at the contact surface of commutator and brush.—*La Lumière Elec.*, June 6.

Parallel Operation of Alternators.—F. LUX.—An abstract of a paper read before the German Association of Electrical Engineers on an automatic device for connection of alternators in parallel. The device fulfils two functions. The first function is to connect two alternators in parallel as soon as they are in phase. The second function of the device is that it automatically changes the speed of the second machine to be connected in parallel with the first machine until the period of the second machine becomes equal to that of the first. The present abstract contains no details.—*Elek. Zeit.*, June 25.

Dynamo with Constant Torque at Variable Load.—J. BETHENOD.—A mathematical paper in which a simple diagram is given for the discussion of the conditions under which an ordinary compound-wound dynamo will operate with constant torque when the current varies. Some applications to electric-gasoline automobiles are referred to.—*La Lumière Elec.*, May 30.

Heating of Electric Machines.—R. GOLDSCHMIDT.—A note on a paper read before the German Asso. Elec. Eng. The author attempts to treat systematically the fundamental laws of heating in electric machines and to suggest new experiments. The present abstract contains only the general contents of the paper without details.—*Elek. Zeit.*, June 25.

Lamps and Lighting.

New Lamps.—W. WEDDING.—An abstract of a paper read at the recent convention of the German Assoc. of Elec. Eng., giving an account of the progress made with the new metallic-filament lamps in reducing the specific power consumption. With respect to the competition between gas and electric lighting, the author thinks that the main thing to strive at in future will not be a further reduction of the specific power consumption, but reduction of the cost of maintenance. He thinks that the lamp of the future will not be the 110-volt metallic-filament lamp, but the 220-volt 16-cp metallic-filament lamp which is not yet in existence, but which would decide the competition with gas in favor of electricity.—*Elek. Zeit.*, June 25.

Arc Lamps and Metallic-Filament Lamps.—REMANE.—An abstract of a paper presented at the recent meeting of the German Assoc. of Elec. Eng. On the basis of an extensive array of figures and curves the author states that high-candle power osram lamps have commercially proved successful beyond expectations. Their economical superiority over arc lamps and their universal applicability for all systems and for all voltages, the quietness and the agreeable color of the light and the fact that they do not need any attendance or repair make their use preferable wherever cheap sources or medium candle power are desired. Recent progress in arc lamps has been made chiefly for high-candle power lamps, while recent progress in incandescent lamps has mostly improved sources of light of medium output, while the small sources of light have not been greatly affected by such progress. For this reason it was to be expected that the economical point at which the arc lamp becomes superior to the incandescent lamp would be changed toward a higher candle power.—*Elek. Zeit.*, June 25.

Excessive Voltage and the Life of Lamps.—REMANE.—A note on a paper read at the recent annual meeting of the German Assoc. of Elec. Eng. On the effect of using metallic-filament lamps, and especially osram lamps, at higher than the normal voltage which has been determined by the factory and is marked on the lamps. The result is a considerable diminution of the useful life or the absolute life. While figures were given in the paper they are not contained in the present abstract.—*Elek. Zeit.*, June 25.

Osram Lamps.—A note stating that for some time the German Welsbach Company has been making osram lamps for from 200 to 250 volts on a commercial scale and in large quantities for outputs of 40, 50 and 100 hefner candles. With the exception of the 100-cp units these lamps may be used in any position.—*Elek. Zeit.*, June 4.

Effect of Ultraviolet Rays on the Eye.—F. SCHANZ AND K. STOCKHAUSEN.—An abstract of an illustrated lecture before the German Assoc. of Elec. Eng. Our artificial sources of light have in the course of time become more and more rich in ultraviolet rays, as a result of the increase in temperature of the glowing body. The ultraviolet rays have serious effects on the eye, producing inflammation and internal changes in the eye. The glass globes with which our commercial lamps are covered do not afford sufficient protection, since they permit the passage of ultraviolet rays of the wave length of 300 to 400 $\mu\mu$, which are the most dangerous to the human eye. The authors have devised a kind of glass called euphos glass which offers sufficient protection without essential diminution of the candle power of the lamps.—*Elek. Zeit.*, June 25.

Generation, Transmission and Distribution.

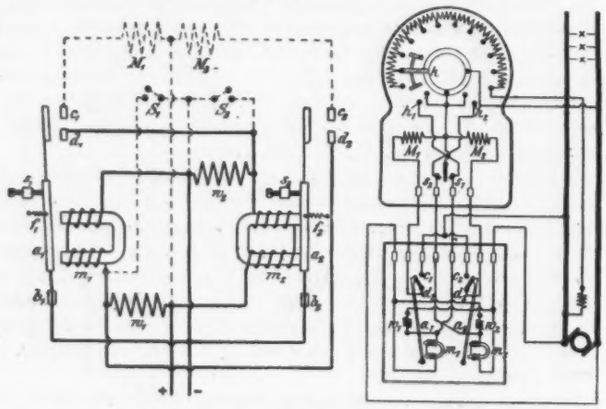
London Mint.—An illustrated description of the new electrical equipment of the Royal Mint in London. While formerly all the different machines were driven by a system of shafting from three steam engines, all have now been changed over to electric drive. The current is supplied by two 200-kw, 110-volt, direct-current generators.—Lond. *Elec.*, June 12.

Traction.

Electric Traction in Germany.—E. Schiff.—In an article on the industrial conditions in Germany in 1907 it is mentioned that the use of storage batteries for traction is increasing on light railways in Prussia. The question of the advisability of introducing electric traction on main roads is not yet ripe to be answered definitely; in each case special preliminary investigations are necessary. Electric operation by the single-phase system has been started on the Hamburg-Altona-Blankenese road and is said to be "satisfactory." In the beginning and again recently troubles have been experienced "which, however, prove nothing against electric traction on main roads per se." A few very heavy electric locomotives for trunk roads have been built for the Government.—*Elek. Zeit.*, June 11.

Installations, Systems and Appliances.

Automatic Regulators.—P. Thieme.—An illustrated description of an automatic voltage regulator which may be used instead of a contact voltmeter in many cases where the latter would not be satisfactory (for instance, in cases where there are strong vibrations). Fig. 1 shows the principle; + and — are the two points at which the voltage is to be held constant; m_1 and m_2 are electromagnets acting on armatures a_1 and a_2 against the springs f_1 and f_2. Under normal conditions the armature a_1 is not attracted, while armature a_2 is attracted, so that both contacts c_1 d_1 and c_2 d_2 are open. The electromagnet m_1 acts when the voltage rises above normal value, while m_2 acts when the voltage decreases below normal value. If, for instance, the voltage rises beyond the permissible maximum value, the attractive force of the magnet m_1 is greater than the force of the spring f_1, and a_1 is attracted by m_1 and the contact



FIGS. 1 AND 2.—AUTOMATIC REGULATORS.

c_1 d_1 is closed. When a_1 makes contact with m_1, the magnetic reluctance is greatly decreased and the tractive force greatly increased so that it is much stronger than the force of the spring f_1. This represents a certain difficulty in opening the contact c_1 d_1 again, when the voltage goes down to its normal value due to the action of regulating mechanism M_1. For this reason the switch S_1 is automatically closed by the regulating mechanism M_1, which short-circuits the winding m_1. The tractive force of the magnet is thereby reduced and the spring f_1 draws the armature a_1 away from the magnet. Simultaneously the switch S_1 is automatically opened so that the normal conditions are re-established. The action of m_2 is similar except that under normal conditions the armature a_2 makes contact with m_2. This contact is broken, when the voltage decreases. The mechanism M_2 then acts and the voltage rises, resulting in the closing of the switch S_2; the resistor w_2 is thereby shunted and the tractive force of m_2 is increased and contact c_2 d_2 is opened. M_1 and M_2 represent the regulating mechanism, which is shown more in detail in Fig. 2. M_1 and M_2 are two magnet coils which actuate a lever k, constructed as a sliding contact to cut resistance in or out. At normal voltage the armature of m_1 is released, while that of m_2 is attracted. The contacts c_1 d_1 and c_2 d_2 are opened and no current exists in the coils M_1 M_2. If the voltage decreases below a certain minimum value the magnet m_2 releases its armature and current is produced in the coil M_2. This causes the arm k to move and make contact with the next notch to the right, thereby increasing the voltage. Simultaneously S_2 is closed and thereby the resistor w_2 in series with m_2 is shunted so that m_2 attracts its armature, breaks the contact c_2 d_2, and the coil M_2 no longer carries any current. The switch S_2 is then automatically opened and the original conditions are re-established. If the movement of the brush k has brought the voltage back to its normal value the regulator remains at rest. If, however, the normal value has not yet been reached, the regulator acts again and arm k moves further until the voltage is brought back to its normal value. Some details of the mechanism are described.—*Elek. Zeit.*, May 28.

Excessive Voltages.—C. Feldmann.—An abstract of a paper read before the German Assoc. Elec. Eng. on excessive voltages in transmission lines, their causes, effects and remedies. Oscillations occur as causes, accompanying phenomena and results of excessive voltages. The author discussed the propagation of these oscillations, their reflection and superpositions, etc. He emphasized that often one set of waves, for instance those due to a single earth connection, may produce other dangerous waves, when the simple earth contact develops into a short-circuit; this may have exceedingly serious consequences. The author described such a case and gave its mathematical analysis. The most dangerous cause of very excessive voltages is, according to the author, found in the case of a short-circuit arc which is extinguished by itself and then starts again. The excessive voltages occurring in this case are of the order of magnitude of a direct lighting flash into the network. There is no remedy which would always be effective in this case. However, lightning arresters and circuit-breakers act quickly and have a strong damping effect, mostly in the first half-period. Those causes of oscillations which cannot be avoided under ordinary conditions of service produce excess voltages of only 50 to 70 per cent, or, theoretically, at most, 100 per cent. Interruptions of operation may be generally avoided or mitigated by the use of lightning arresters, inductance coils, resistors and by "earthing" the neutral points. In discussing these well-known protective devices the author referred to the effect of distributed capacity and inductance to explain unexpected phenomena.—*Elek. Zeit.*, June 25. The first two installments of the full paper, which seems to be very long, appear in *Elek. Zeit.*, June 18 and 25.

Protection Against Excessive Voltages.—K. Kuhlmann.—An abstract of a paper read before the German Assoc. Elec. Eng. The author discussed the excessive voltages produced in overhead transmission lines. In his discussion of protective devices he mentioned the protection obtainable from condensers, from earthing of the neutral points of generator, etc. He thinks that lines of high voltage are comparatively less endangered by atmospheric discharges than low-voltage overhead lines since the insulation resistance of the former is very high and the protective devices can be adjusted more exactly. For networks which consist exclusively of cables he recommended the avoiding of the earthing of spark-gaps and their resistances. He suggested to calculate with a "factor of electric safety" just as mechanical engineers speak of the factor of mechanical safety. For this purpose he proposed the use of the ratio of the perforation voltage (after about three seconds) to the line voltage as a measurement of the degree of electric safety.—*Elek. Zeit.*, June 25.

Free Oscillations on Long Lines.—K. W. Wagner.—An abstract of a paper read before the German Assoc. Elec. Eng. When the conditions are suddenly changed in an electric line with distributed inductance and capacity, the former stationary condition does not change directly into a new stationary condition. There is a transitory stage characterized by free oscillations which permit the gradual change from the first to the second stationary state. The author discussed the phenomena in the transition stage, with reference to the effectiveness of protective devices.—*Elek. Zeit.*, June 25.

Oscillation Analogies.—I. Doery.—An abstract of a paper read at the recent annual meeting of the German Assoc. Elec.

Eng. Sudden changes in the load of turbines with long penstocks cause the production of oscillation and changes of pressure within the penstock. These phenomena are entirely analogous to electric oscillations and the excessive voltages produced in transmission lines by the sudden change of the constants of the electric circuit. Moreover, the periodic variations of speed of the turbine regulator produce forced oscillations which are superposed on the free oscillations so that resonance may occur just as the e.m.f's. impressed on the line from the generator may produce resonance. There is not only a similarity between hydraulic rises of pressure and exeessive electric voltages, but for both phenomena exactly the same formulas and equations may be used. On this account the known electrical formulas may be made use of in the design of penstocks.—*Elek. Zeit.*, June 25.

Excessive Voltages.—RIDDERVOLD.—An abstract of a paper read before the Hanover Electrical Society on dangerous excessive voltages produced in transmission lines by short-circuits, and on the use of discharge-gaps as protecting devices.—*Elek. Zeit.*, May 28.

Electrophysics and Magnetism.

Photo-Electric Cells.—P. HODGE.—An abstract of an Am. Phys. Soc'y paper, giving an account of a study of photo-electric cells containing a fluorescent electrolyte. It was first found that there was practically no change of conductivity of the fluorescent solution when under the influence of the exciting light. The author then investigated the effect of illuminating the anode and the cathode in turn, changing the potential difference at the terminals of the cell from 0.0 volt, by small stages up to 3.6 volts. Very large changes in apparent resistance were observed when the potential differences were small, the effect at the cathode being to greatly decrease the resistance, that at the anode to increase it by about the same amount. As the potential difference became greater these effects became less, and finally the effect on the cathode became an increase of resistance and that at the anode a decrease. Of these latter effects that at the cathode was much the greater. Finally, both effects were lost at about 3.5 volts. The author also investigated the photo-active effects produced by illuminating one electrode only, no external e.m.f. being applied. This effect, in the case of a number of fluorescent substances which have strong absorbing power, has been found quite large, the e.m.f. produced reaching a maximum of between two-tenths and three-tenths of a volt, near the infra edge of the absorption band, falling off abruptly as the electrode leaves the absorption band on the infra side, and much more gradually toward the violet. In all cases thus far observed, when alcoholic solutions were used, the exposed electrode became positive to the unexposed. In the case of one cell with fluorescein in water solution the effect was of opposite sign.—*Phys. Review*, June.

Effect of Wave-Form on Magnetic Hysteresis.—M. G. LLOYD.—An abstract of an Am. Phys. Soc'y paper, giving an account of experiments in which, by means of the wattmeter method, the total iron losses were determined and the hysteresis and eddy current components were separated by using two frequencies and applying the modified form of the Steinmetz formula $W = a\, n\, B^x + b\, n^2\, B^2\, f^2$, where W is the power expended, n the frequency, B the maximum value of the flux density, a and b constants of the material, and f the form factor of the e.m.f. produced in a coil enclosing the flux. The form factor is altered by introducing resistance in the magnetizing circuit or by some other means. The change in eddy-current loss with form factor can be computed, and the change in total loss measured. If these are not equal, there must also be a change in hysteresis. The author experimented with rings, made up by using sheet iron or iron wire. The results show that if there be any change in the hysteresis, with change of wave form, when B is kept constant, it is very small.—*Phys. Rev.*, June.

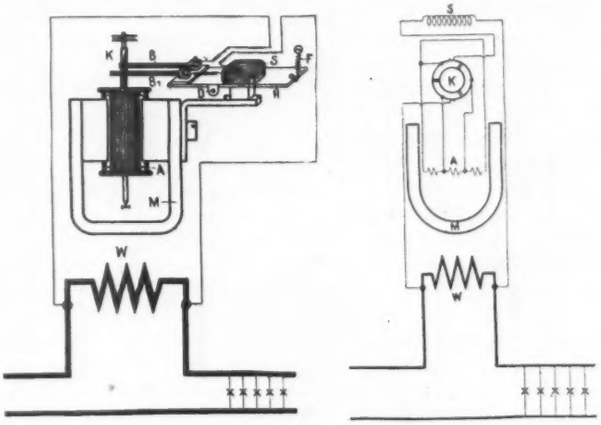
Electrochemistry and Batteries.

Annealing and Hardening Furnace.—STRAUBE.—An abstract of a paper read before the German Assoc. of Elec. Eng. on an annealing and hardening furnace for the steel industry. The furnace contains a fused electrolyte, which is heated by resistance heating. The articles to be annealed or hardened are simply inserted within the fused bath. The chief features are absolute uniformity of the temperature in the bath and the possibility of regulating it easily and exactly. It is claimed that the latest form of this type of furnace, which is operated by three-phase currents, is very economical.—*Elek. Zeit.*, June 25.

Measuring Conductivity of Electrolytes Without Electrodes.—L. COHEN.—An abstract of an Am. Phys. Soc'y paper, in which the author proposes the following method: If a tube filled with an electrolyte is inserted into a solenoid and then an alternating current is passed through the winding of the solenoid, eddy currents produced in the electrolyte will heat the electrolyte and thus consume a certain amount of energy. If the solenoid forms one arm of a Wheatstone bridge, through which a high-frequency current is passed, and if the resistance is determined with and without the electrolytic core, there will be a difference in the two measurements, for the loss of energy in the elctrolyte will be equivalent to the insertion of an additional resistance in the arm of the bridge. The change in resistance measured in the bridge will be proportional to the conductivity of the electrolyte. The author gives the fundamental formula of the theory and a numerical example to show that the effect can be found experimentally.—*Phys. Rev.*, June.

Units, Measurements and Instruments.

Ampere-Hour Meter.—A. KOENIGSWERTHER.—A paper read before the German Assoc. of Elec. Eng. In the usual direct-current ampere-hour meter, which is built as a motor meter, a difficulty is experienced, especially at low loads, on account of



FIGS. 3 AND 4.—AMPERE-HOUR METER.

variations of the transition resistance between commutator and brushes. The author discusses various remedies which have been proposed. Since such changes of transition resistance are due to the accumulation of dust or metallic oxides, a successful remedy is to remove this dust mechanically by a movement of the brushes. This movement must take place automatically and immediately as soon as the transition resistance begins to change. The employment of this principle is illustrated in Fig. 3. M is the magnet, A is the armature, K the commutator. The brushes B and B_1 are mounted on the two-arm lever H, which can revolve around the axle D. The other arm of the lever carries the coil S, which moves in a leakage field of magnet M so that it is attracted or repelled. The coil D is in series with the armature A, as is shown in Fig. 4. The connection with the shunt W is by means of fine spiral springs. The spring F brings the lever H back into its original position after the current has ceased to act. The operation is as follows: When, as a result of a small variation of transition resistance between commutator and brushes, the current in the system and therefore in the coil S changes, the latter moves and simultaneously causes the brushes to move. As a result of the mechanical movement of the brushes on the commutator, the latter is cleaned and the current in the system comes back to its normal value and the brushes resume their former positions so that the lever H continually makes small movements as soon as any changes are developing in the transition resistance. A meter of

the Allg. Elek. Ges., embodying this principle, is described in detail with many illustrations.—*Elek. Zeit.*, June 18.

Thermoelement.—W. P. White.—An abstract of an Am. Phys. Soc'y paper, in which the author discusses what is the most important portion of a thermoelement. Along a thermoelement, as ordinarily used, there are three temperature regions: one fairly constant at each end and an intermediate gradient region where the temperature changes from one of the end values to the other. In an element used with a cold junction in ice, there are usually two such temperature systems in series. The temperature measured is that of the junction, but it is measured in terms of the thermoelectric power of that part of the thermoelement which passes through the gradient region of temperature and not of that lying near the junction. Inhomogeneities, permanent or temporary, in the other portions are much less important than in the gradient region. This is an extension of the well-known rule that solder or other foreign material at the junction affects the e.m.f. but little. In selecting wire for a thermoelement the gradient portion is, therefore, the only part where great care need be exercised. The production of a good thermoelement is thus easier than has sometimes appeared. If an inhomogeneous element is shifted to a different depth in the bath or furnace, it becomes generally at once a different element. The effect of a change in the material near the junction, however, is much less important. In amputating a contaminated platinum thermoelement to restore its original value, it is usually practically sufficient to cut off only enough so that fresh, uncontaminated wire occupies the gradient region. Commercial constant on wire can be had from which, by selection and combination, thermopiles may be constructed good to 0.001 deg. at 100 deg. C.—*Phys. Review*, June.

Distributed Capacity in Resistance Boxes.—A. H. Taylor and E. H. Williams.—An account of experiments in which the authors determined the error introduced into alternating-current measurments by the distributed capacity of the ordinary, non-inductively wound coils of a resistance box. The authors first wound some "ideal coils" on wooden frames; the windings were bifilar and were braided together before being wound; consecutive turns were, however, separated by 5 mm. The braiding insured that the coils were absolutely non-inductive, but it seemed possible that there might be some noticeable distributed capacity. However, experiments showed that this was so small that even when increased several fold it would be negligible. Comparisons were then made with commercial resistance-box coils, partly of American and partly of German make. The German coils were wound on brass, heavily coated with shellac and baked very hard. The American coils were wound on wood and coated with shellac. The German coils were found to have a high distributed capacity, eight times as high as that of the American coils. The reason of the high capacity of the German coils was found to be that in order to increase their ability to carry current, they are made of rather large, and hence long, wire. This large surface gives an abnormal value to the distributed capacity, which is still further slightly increased by the fact that, in order to facilitate cooling, the coils are wound on brass cores, so that even after days of baking the inner layer of shellac does not dry through. This probably results in electrolytic action, causing an increase of capacity. While the German coils are excellent for direct-current work they possess a serious defect from the standpoint of precise alternating-current measurements. There is a distinct advantage in building up a large resistance out of smaller units. —*Phys. Rev.*, June.

Instruments.—J. Reyval.—A continuation of his illustrated article on exhibits of apparatus and instruments at the recent exposition of the French Phys. Soc'y in Paris. Among the instruments described more in detail are the electromagnetic compass of Dunoyer, which is specially suited for use on battleships and submarine boats, and the latest form of the Abraham-Carpentier rheograph, which consists of two main parts, the double galvanometer and the synchronoscope. By means of this rheograph it is possible with a 0.01-amp. 50-period current to project on a screen at 3.5 meters distance a curve of sufficient amplitude for lecture-room demonstrations. Various other instruments are briefly described.—*La Lumière Elec.*, May 30.

Miscellaneous.

German Association of Electrical Engineers.—An account of the proceedings at the recent Erfurt meeting, which was the sixteenth annual meeting, the president, Prof. W. Kohlrausch, in the chair. The number of members has increased during last year from 4057 to 4303. The finances appear to be excellent. the association having in bank almost $30,000. The organ of the association, *Elektrotechnische Zeitschrift*, has a circulation of 9400. Various sets of standardization rules (arc lamps, photometry of arc lamps, etc.) were voted upon and accepted. (Abstracts of all the papers presented at the meeting will be found elsewhere in the Digest.)—*Elek. Zeit.*, June 25.

The Industrial Conditions in Germany.—E. Schiff.—A review of the present conditions, especially of the electrical industry, in Germany, on the basis of the last report of the Berlin Handelskammer. The consumption of coal in Germany has doubled during the last 12 years, and the price has increased. One hundred and twenty-four thousand tons of copper (against 126,000 in 1906) were imported into Germany in 1907, while 6100 tons were exported (against 7200). The output of copper and rubber in the German colonies is still low, but the prospects seem good. The number of all employed workingmen in Greater Berlin had a minimum of 785,000 in January and a maximum of 846,000 in November; 35 per cent of all employees are women. While, as a result of last year's crisis, some important iron works stocks dropped as much as 60 per cent, the electrical companies were less affected in the stock market. As prime movers in electricity works, steam turbines are now almost exclusively used for larger outputs. For smaller sizes, suction gas-engines are increasing in favor, while Diesel engines are also used in many cases. One hundred new gas works were erected in 1907, and the existing plants were largely increased. Several gas central stations supplying energy to larger districts have been erected. In electric-transmission plants the tendency is to raise the voltage; in two cases a voltage of 50,000 has been adopted. In mines and metallurgical works the centralization of electric-power supply, the utilization of blast-furnace gases, are making good progress. Mine pumps are now almost exclusively driven by electricity. The methods of reversing rolling mills have been revolutionized by the introduction of electric systems. In spite of an increase in output of the electrical industries, the number of workingmen employed has been decreased, as a result of improved organization.—*Elek. Zeit.*, June 11.

Government Ownership.—A note on the tendency of various European countries to bring electric-supply plants under government ownership. Belgium has licensed four transmission plants in Brussels, Charleroi, Antwerp and in Ostende for 25 years; after this time all the cable networks become the property of the government, which also has the right to inspect and acquire the plants. The four plants have sufficient capacity to supply electric energy to almost the entire country of Belgium and the different cable networks can be interconnected. Belgium municipalities have the right to grant franchises for 18 years only. The county of Zurich, in Switzerland, has acquired the electricity works on the Siehl. Bavaria grants franchises for coal mining only under the condition that the government has also the right to mine coal, while franchises for water-power development are granted only for a certain period under the condition that the government may then take the plant over.—*Elek. Zeit.*, May 21.

X-Ray Test for Death.—M. Menard.—The author questions the effectiveness of the X-ray test for death. Vaillant has maintained that the radiographic aspect of the intestines is decisive for or against death, but some radiographs taken by the author show that the aspect is the same 80 minutes after death as it is 5 minutes after the cessation of respiration, except that some of the convolutions are discernible. The convolutions are all traceable 20 hours after death, but by that time other physical signs usually relied upon have set in. The visibility of the walls of the intestine is not a matter of structure, but simply of thick-

ness. An intestine distended by gas becomes invisible on radiographs because the walls become thinner. This was proved by direct experiments with the intestine after removal from the body. The invisibility of the intestine cannot be attributed to phosphorescence, as that would have no power of penetrating the other tissues.—*Comptes Rendus*, May 25; abstracted in Lond. *Elec. Eng'ing*, June 18.

BOOK REVIEW.

DAS ELEKTRISCHE BOGENLICHT. By Walther Biegon von Czudnochowski. 698 pages: 397 ills.; 134 tables; 29 plates.

The major portion of this work may be considered as a complete history of the invention and development of the arc lamp in its various forms. It should be noted, however, that theory and practice have not been neglected; the author has merely selected that method of presentation which allows him to relate the history while discussing the phenomena of the lamp and the details of its construction. Almost all known features of arcs of every kind are dealt with. After introductory remarks relating to lighting in general and photometry, which occupy 98 pages, 492 pages are devoted to historical matter; the remaining 198 pages deal with the lamps as they are constructed and operated at the present time. The book is one of the most complete and thorough that has yet been written on the arc lamp, especially is this true concerning the historical portion.

NEW APPARATUS AND APPLIANCES

Effective Lighting Fixtures in the West.

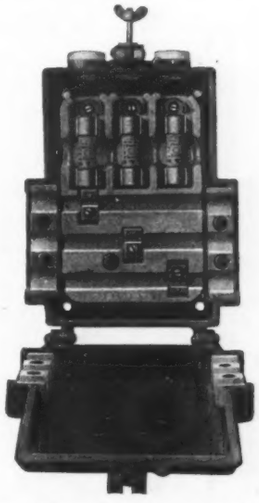
The lighting fixture business in the West has for years been considered a commercial proposition of se'ling so much metal for its equivalent in money. Most wonderful forms have been created and placed in various buildings without regard to whether such pieces harmonize with the surroundings. The architect, contractor and the consumer have for years visited fixture show rooms contemplating purchase of lighting effects for their building, whether such building be for public use, or for the home, and have been greeted by a maze of metal so dense that it has always caused confusion to the purchaser. After purchasing the desired amount of metal for the building, there still remained a serious doubt as to whether such pieces as were selected were really appropriate. This condition has caused many disappointments.

For years the Central Electric Company, located at 264-270 Fifth Avenue, Chicago, Ill., has been aware that such conditions as described above existed in the West, and after looking carefully at all sides of the situation decided that as a fixture house sufficiently progressive to take a stride forward, it would be appreciated and patronized in a manner which would be profitable. The first step was to acquire a factory equipped with the many esential points necessary to the production of correct and unusual effects in metal. To secure the craftsmen for such an organization, it was obliged to locate its factory in Boston, where it now has a designing department, and a highly efficient factory organization, each man selected with the greatest of care, bearing in mind that to give the public what they desire from the designer of the various effects through to the modeler, the foundry man, the toolmaker and the chaser, there must be in their temperament the necessary feeling for art in its true meaning.

The following quotation will give some idea of this company's interpretation of the true meaning of the lighting fixture business: "A lighting fixture must have two inceptions; first, in the designer's thought, made apparent by the use of the pencil, and second, by craftsmen of sterling worth. It is the service of such an organization that they offer." In building their Chicago studios, great care was given in the arrangement of the various rooms, so that each fixture is seen individually, and under conditions which enable the purchaser to make intelligent selection. They have avoided crowding the rooms—each piece shown therein being lighted, thus enabling one to see the effect as it will be when the fixture is permanently placed. The sales organization is composed of representatives having a thorough knowledge of interior architectural detail, so that when a prospective client makes known the conditions existing in his building, correct suggestions can be offered. The studios are beautifully decorated rooms for the display of lighting effects in the West, and every courtesy and convenience is shown prospective clients. The Central Electric Company cordially extends an invitation to those interested to visit these studios as a study in illuminating engineering.

Weather-Proof Branch Box.

The branch box illustrated herewith has been designed for use both as a "cut-out" and a switch, and is intended for use on the outside of a building where overhead wires enter, or in a cellar where the wires enter from a subway. The service switches are so designed that the neutral fuse remains permanently in the box, thus avoiding any possibility of accidents due to the fuse being improperly withdrawn. Withdrawal hooks are provided on the positive and negative leads only. This arrangement avoids any possibility of tampering with the box through ignorance or otherwise and thus so leaving the



WEATHER-PROOF BRANCH BOX.

box that in case of fire the neutral fuse may be drawn, leaving the other fuses in the box.

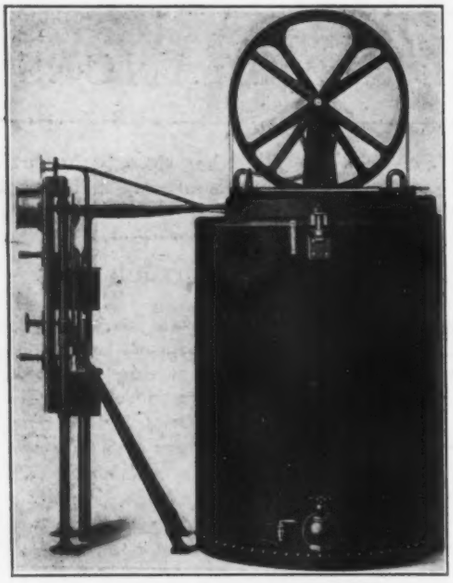
Fuse guides are mounted in the covers to align the fuses accurately, so that positive contact is made when the cover is again closed, thereby throwing the fuses into circuit. There are also mounted in the covers withdrawal hooks which, by one-quarter turn of the levers on the outside of the cover, remove the positive or negative fuse at will; when desired the cover can also be opened without removing any of the fuses. The fuses are of the D. & W. National Electrical Code Standard, and the boxes are provided with rubber gaskets and removable porcelain bushings, thus making them throroughly moisture-proof when the cables are taped in.

This line of cut-out boxes, which is built in ratings up to

400 amp, either triple-pole or double-pole, is being placed on the market by the Central Electric Company, Chicago, Ill.

Mercury Rectifier Arc Lighting System.

An arc lighting system that is claimed to have proved highly successful in practice consists of a combination of alternating-current regulating transformers and mercury-arc rectifiers with direct-current series-connected arc lamps. The regulating transformer illustrated herewith is of the repulsion-coil type, and is oil-insulated and oil-cooled. It is so arranged that when connected to a constant-potential alternating-current supply system it delivers an alternating secondary current of constant



CONSTANT-CURRENT TRANSFORMER.

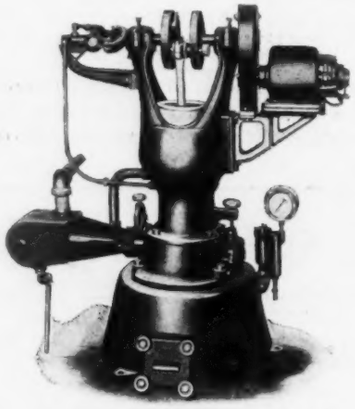
effective value. In connection with the regulator use is made of a single-phase Cooper Hewitt mercury-vapor converter for rectifying the current for use in the lamps. It is stated that the above combination allows one to obtain the superior qualities of direct-current arc lamps, together with the highly efficient method of distribution and control of electrical energy offered by the alternating-current system.

The equipment outlined above has been placed on the market by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

Vacuum Cleaning.

Many types of vacuum cleaners have been developed in the past few years for all sorts of conditions. For office buildings, hotels, theaters, large residences, etc., a very satisfactory type is that forming a permanent part of the building, as there is nothing to handle but the light hose and tools. A pump in the basement driven by a small motor does the work. Special pipes are provided with neat outlets in convenient locations on the various floors. At these points a flexible hose may be attached and the surrounding floors, walls, ceilings, furniture and upholstery thoroughly cleaned and renovated.

One of the most satisfactory of these systems is that supplied by the Palm Engineering Company, of Detroit, Mich., which is herewith illustrated. A feature of importance is the method of starting the motor. Remote control can be provided so that it is only necessary to press a button at the outlet where the hose is to be attached and the motor starts the pump. Again pressing a button stops the motor, so that it is unnecessary to go to the basement at all. The motor and the pump are of very rugged and substantial construction, so that but little attention is required. The motor is of standard Westinghouse design. It is of but ½-hp rating, but is said to be ample to do all the work required. The pump is of the plunger type, but has a loose fitting piston. The feature of the system is the means adopted for obtaining the vacuum with this loose fitting piston. Water is supplied to the cylinder and produces the effect of a tight piston without the friction and wear which would result from the dirt and dust if the piston actually made contact with



VACUUM CLEANING APPARATUS.

the cylinder. In this system no separators are required and the efficiency is correspondingly increased. The entire outfit is very compact and substantial. It is entirely self-contained and requires no foundation except a good floor.

Portable Volt-Wattmeter.

The portable volt-wattmeter illustrated herewith has been designed primarily for the measurement of the power consumption of an incandescent lamp and for ascertaining the voltage at the terminals of the lamp. It combines in one instrument a voltmeter and a wattmeter, and is equipped with a switch to change the indications from volts to watts, two scales being provided for this purpose. The instrument is constructed on the electro-dynamometer principle, and hence can be used with either direct current or alternating current.

The instrument is equipped with two binding-posts for the purpose of connecting into circuit, the connection being made by means of plug and cord from any convenient lamp receptacle. It is also provided with a flush-lamp receptacle for Edison base and a switch for throwing the instrument into and out of circuit. In the case of double-range instruments, there is provided a second switch which normally connects the instrument to the 300-volt coil and which, on being turned, joins

PORTABLE VOLT-WATTMETER.

to the 150-volt coil. The series coil is designed for currents not exceeding 1.5 amp.

While the instrument is particularly useful for testing lamps, it is also well adapted for use as a voltmeter or as a wattmeter for any device which does not consume more than 1.5 amp. It has been placed on the market by the Keystone Electrical Instrument Company, Philadelphia, Pa.

A Sixty-Foot Switchboard.

A switchboard of unusual dimensions has recently been built by the Trumbull Electric Manufacturing Company, Plainville, Conn., for the Phelps Publishing Company, Springfield, Mass. The board has a total length of 60 ft. and contains 30 panels. The first nine panels are for distributing energy to a three-wire 2 x 125-volt lighting system. Panel No. 10 is for an equalizer balancer for obtaining three-wire service from two-wire mains. Panel No. 11 contains a 4000-amp circuit-breaker for the lighting main. Panels No. 12, 13, 14 and 15 are for two-wire generators, while Nos. 16 and 17 are spare panels. Panels Nos. 18 to 25, inclusive, are for 250-volt motors, and panels Nos. 24 to 27 are for 500-volt motors. Panel No. 28 is an instrument panel for 250-volt and 500-volt wattmeters, and Nos. 29 and 30 control boosters for obtaining 500-volt power from the 250-volt generators.

Automatic Voltage Regulators.

In order that a practically constant voltage be maintained at a distributing point the e.m.f. of the generator should be controlled by a potential regulator so as to maintain a constant voltage at the bus or sub-station. The e.m.f. of the various feeders branching out from the station should also be controlled by feeder regulators arranged so as to automatically compensate for the drop in that particular feeder, due to varying loads. By this system of voltage regulation a practically constant potential may be maintained at the individual distributing points.

It is possible to dispense with the regulator controlling the voltage of the generator by equipping the individual feeders

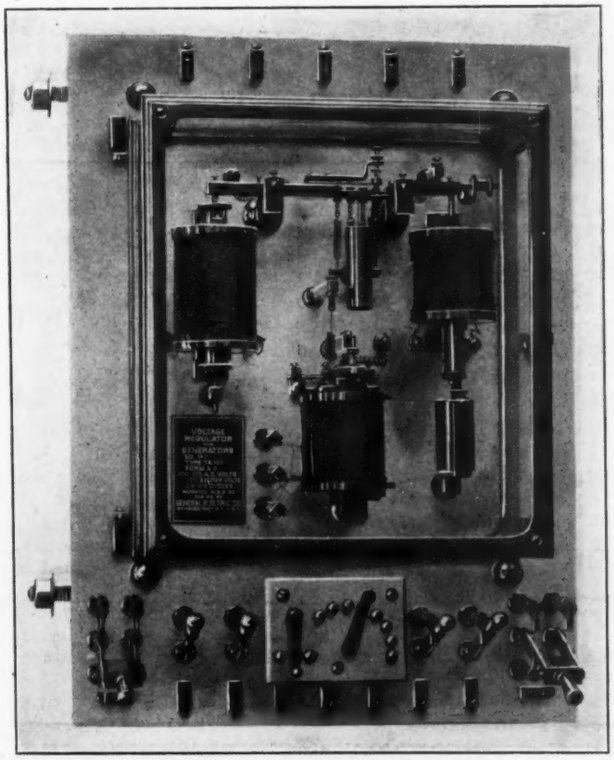


FIG. 1.—VOLTAGE REGULATOR MOUNTED ON MARBLE BASE.

with regulators of sufficient size not only to compensate for line drop, but also to compensate for the voltage variations at the generator. It is, however, advisable, both on account of economy and operating conditions, to control the e.m.f. of the generators by a special regulator. A Tirrill regulator for this purpose is shown in Fig. 1; it is a relay device mounted on the switchboard, and is so adjusted that it controls the generator voltage by rapidly opening and closing a shunt circuit across the field rheostat of the exciter. The action of this regulator is very rapid, and there is practically no fluctuation in the voltage. By its use, the kilowatt rating of each regulator for the individual feeders is reduced as well as the number and amount of their adjustments.

FIGS. 2 AND 3.—AUTOMATICALLY OPERATED FEEDER REGULATOR.

Two types of regulators are manufactured by the General Electric Company for automatically controlling the voltage of individual feeders. The feeder regulators of the above types are variable-ratio transformers or auto-transformers, having two separate and distinct windings, primary and secondary, connected respectively across and in series with the feeder, the voltage of which is to be controlled. Both types of regulators perform the same function, the principal difference in the results being in the rapidity with which they operate.

The regulator, shown in Fig. 2, consists essentially of a transformer, the secondary of which is divided into a number of equal sections, and a dial switch, the points of which are connected to the sections of the secondary winding. In this type of regulator the moving element is exceedingly light and, having but little inertia, is particularly adapted for very rapid adjustments. The total time required for obtaining the complete range from maximum boost to maximum lower is about 6 seconds.

This regulator is built exclusively for single-phase circuits and in comparatively small units, since the output is limited by the current and voltage which can be conveniently handled by the switch.

The induction regulator, shown in Fig. 3, is more rigid, and substantial in construction, and has a less number of moving parts than the switch type, and no moving contacts. The efficiency is somewhat higher, but it is slower in operation than the other regulator as the movable core on which the primary is wound has not only considerable inertia, but also a torque depending on the load, both of which must be overcome by the operating motor. The secondary or series winding is arranged in slots on the inside circumference of the stationary core, and the variation in the feeder voltage produced by the regulator is due entirely to the change in the angular position of the two cores.

The latter regulators are built for operation on single-phase or polyphase circuits. Although used principally for the control of lighting circuits, induction regulators are equally well adapted to motor circuits, on which they have been used principally in connection with polyphase rotary converters.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

It is not out of place in discussing the general condition of trade for the week ended July 14 to say that there is an improvement. There was probably no more actual business done than in the week previous—making allowance of course for the holiday—but there were a distinctly better tone, more inquiries and a stronger feeling of encouragement for the future. The nominations at Denver had little to do with the situation. Bryan's selection had been so long discounted that any effect that it might have had on business was nullified. The main feature lending tone to the situation is the excellent crop report, brought out by the government July 8. While there was no promise of bumper yields in either wheat, corn or oats, all of the averages were high enough to assure liberal returns. The report analyzed well from the fact that the averages were exceptionally good in the States where the acreage is heaviest. Figuring on the condition report and acreage figures, the returns indicate that the winter wheat crop will be 7,000,000 bu. greater than last year; spring wheat, 52,000,000 bu.; corn, 134,000,000 bu., and oats about 258,000,000 bu. The general understanding of these figures is that they mean prosperity to the farmer and traffic to the railroads. Good crops practically spell prosperity. When the producers can afford to buy, the wheels of industry cannot remain idle. While the conservatism which has marked this period of depression more than any other in the country's history is still in evidence, there is a prevailing sentiment that retailers are preparing to come to market in goodly numbers. Filling-in orders from jobbers are plentiful, but small, indicating badly broken up retail stocks in all parts of the country. Almost every city is now alive with forced bargain sales, which, of course, further deplete stocks and clear shelves for new goods. In the West preparations are making for buyers' excursions, and there seems to be a more thoroughly organized effort in this direction than ever before. The iron and steel industries report things quiet and the number of either furnaces or mills in operation is probably no larger than it was a month ago. Pig iron production in June was the smallest since February, and the output for six months was 52 per cent below 1907. The expenditures for building for six months were 31 per cent smaller than in the first half of 1907. Railway traffic is reported to show a little improvement, and railroads are putting increased forces to work at repairing cars, but gross earnings for June fell 18 per cent below a year ago. Cotton has had good weather for growing and rains have helped the crop in Texas to a very material extent. No boll weevils have appeared and the planters feel assured of large yields. Money remains easy and there is a little better demand for commercial paper. There has been some little movement of currency to the West, but the farmers who have harvested seem to be in no hurry to sell, which of itself indicates that their financial condition is satisfactory. Business failures for the week ending July 9, according to *Bradstreet's* report, number 246, which compares with 236 last week, 185 in the like week of 1907, 143 in 1906, 166 in 1905, and 203 in 1904.

THE COPPER MARKET.

There was a slight improvement in the copper market during the week ended July 13, although the advance in quotations was only fractional. A small increase in orders for finished material was recorded by wire drawers and manufacturers of sheets and castings. This apparent awakening of business caused domestic melters to place contracts for several thousand tons to be delivered in July and August, and in some cases as far advanced as September. The speculative buying in London continued to be the most sustaining feature in the market. During the week quotations were advanced ⅛c., but all of the important contracts were written at the old rate of 12⅝c. for Lake. The heavy tonnage carried in European warehouses does much to check any extra activity among the producers, for 90 per cent of this copper must be resold. On the other hand, it is claimed that the greater part of this metal will not be put on the market until 13 cents is the prevailing price, so it may be regarded as a negative quantity with quotations at their present level. It is still estimated that the visible supply of metal in both this country and Europe is nearly 350,000,000 lb. This, with a production that is nearly normal and a consumption that is far below the ordinary average, indicates that accumulations may grow rapidly and may at any moment demoralize the business seriously. At the same time, the interests which are engaged in selling 75 per cent of the copper produced in this country say that the surplus is greatly overestimated. Instead of there being 112,000,000 lb. in the United States, these people figure that there is actually available for immediate consumption less than 50,000,000. As an offset, however, to the liberal production of copper that continues, it is stated from Butte that the mines of that section are producing the metal cheaper than ever before in their history. All unnecessary extravagances have been cut off, employees have been reduced in number, in many instances wages have been lowered and, it is claimed, the efficiency per man has been increased. The mines have, in addition, been paying more attention to high-grade ores, and this in itself is a factor in reducing the cost per pound of the production. It is, of course, apparent that such scaling in the cost of production, in the face of heavy stocks and liberal output, is not an argument in favor of advancing or even sustaining prices. The corrected figures of production for the month of June were 79,431,725 lb., as compared with 96,123,030 for June, 1907. The total production of the American mines for the first half of the year was 467,937,284 lb., which is compared with 563,899,263 in 1907 and 586,494,581 in 1906. Exports from the port of New York on July 13 were 2363 tons, or a total since July 1 of 6385 tons. The arrivals of copper on the same date were about 50 tons of slabs from Japan and 50 tons of bars from Peru. Closing quotations on the Metal Exchange July 13 were:

Lake	12¾ @ 12⅞
Electrolytic	12½ @ 12¾
Castings	12⅜ @ 12½

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	57 11 3	57 15 0
Standard copper, futures	58 5 0	58 7 6
Market	Firm.	Firm.
Sales of spot		150 tons
Sales of futures		200 tons

Extreme fluctuations for the year:

	Highest.	Lowest.
Electrolytic copper, spot	13¾	12¼
Lake copper, spot	13⅞	12⅜
Casting copper, spot	13½	12⅛
London, spot	£64 5 0	£56 5 0
London futures	64 10 0	56 17 0
London, best selected	67 10 0	60 0 0

IN A NEWARK LEATHER PLANT.—The equipment of the power house of M. Straus & Sons, of Newark, N. J., was installed several months ago in their new leather-treating plant. All of the machinery, including engine, generator, exciter, induction motors and switchboard, was purchased from a single builder, Allis-Chalmers Company, Milwaukee. The equipment consists of a 16-in. x 36-in. Corliss engine, direct connected to a 150-kw generator, 60 cycles, three-phase, supplying current at a terminal pressure of 240 volts. The engine runs at 120 r.p.m., non-condensing. The exciter is a 13-kw machine. The induction motor equipment includes 30 motors of Allis-Chalmers Company's standard "AN" type, 220 volts, three-phase. They range from 2 to 15 hp in capacity and operate at speeds from 900 to 1800 r.p.m.

DOSSERT & COMPANY, 242 West Forty-first Street, New York, have received orders for 24 special solderless clamp connectors to be used in connection with Dossert cable taps as an anti-creeping device on the signal system of the New York Central electrical division. They have also received orders for 200 two-way reducers to be used in connecting the feeder cables to the switchboards in the Emporium Building in San Francisco. These reducers range in size from 450,000 circ. mil cable to ¾-in. solid rod down to No. 2 solid. This order also includes 400 terminal lugs ranging from 1,000,000 circ. mil down to No. 6.

BRIGHTENING WESTINGHOUSE OUTLOOK.—With the beginning of July a decided advance has manifested itself in the business of the Westinghouse companies at East Pittsburg. The new orders have been unusually large and there are quite a number of them. At the office of the Westinghouse Electric & Manufacturing Company it was stated that the business for June was 15 per cent above that of May and 23 per cent higher than the business of the earlier months in the year. "There has been an undoubted improvement in our works right along," said one of the officials, "but the opening of July has been more pronounced than before. We have taken some very nice orders within the last few weeks and the inquiries, which are many, show a very decided tendency for an even greater advancement from now on." "In like manner our business has experienced a positive revival," was the statement made at the sales department of the Westinghouse Machine Company, "and within the last month it has almost reached its normal point. While this in itself is very encouraging, the character of the orders we have received are of such a diversified nature and came from so many different sources that they show conclusively the renewed confidence of business men and capitalists. Another feature is that most of the orders we have obtained were for hurry-up delivery. That this revival is not spasmodic is also proved by letters we are receiving from our various district managers, who have informed us that they are coming here to study the improvements and new things in order to prepare themselves for the business which all see is now coming their way." Among the orders is one from the Metropolitan Street Railway Company, of Kansas City, Mo., to the extent of 15,000 hp, consisting of a steam turbine furnished by the Westinghouse Machine Company, and an electric generator of equal capacity, to be made by the Electric company. The Narragansett Electric Light Company, of Providence, R. I., has contracted for a 5000-hp Westinghouse steam turbine and a Westinghouse turbo-generator of the same size. The Mohegan Oil & Gas Company, of Akron, Ohio, has ordered two 1500-hp twin tandem double-acting horizontal Westinghouse gas engines. The Pressed Steel Car Company, of Pittsburg, has ordered one 1500-hp low-pressure turbine and two 750 hp, with the corresponding electric generators. The Coronet Mining Company, of Florida, operating in the phosphate mining district, has ordered three 750-hp steam turbines, electric generators and auxiliary electrical apparatus, as well as condensers. Bullinger & Andrews have ordered two 150-hp gas engines from the Machine company; and automatic stoker orders to the extent of about $40,000 were received from the National Tube Works, of McKeesport; the Berwind-White, of Windber, Pa.; the Public Service Corporation, of Newark, N. J., while an order for a Westinghouse gas engine of several hundred horse-power, with a gas producer, was received from the company's Mexican agent, G. O. Braniff & Company, Mexico City. The apparatus represented by these various orders aggregates about $1,500,000.

BIDS WANTED FOR CHILI INSTALLATION.—Alfred A. Winslow, United States consul at Valparaiso, Chili, reports to the bureau of manufacturers of the Department of Commerce and Labor that the management of the State railways in Chili has advertised for bids for the construction of an electric plant at San Eugenio, comprising the buildings and the machinery for the production of motor force in the shops and the lighting of the stations, with a capacity of 900 kw, divided into three units of 300 each. No proposals will be considered that are not made upon the form that will be found in duplicate on the leaf of specifications furnished free of charge by the engineer of the technical office upon a deposit of 60 pesos with the central cashier of the service. The work must be executed in conformity with these specifications. At the time of receiving the specifications the interested party or his representatives will sign the volume kept for this purpose in the central office, giving their name and the domicile of the house they represent. The management reserves the right to reject all proposals, to accept any part of any of them, or to accept the one most convenient, even though it is not the lowest. The proposals will be opened in the presence of the interested parties Monday, Nov. 2, 1908, in the office of the director-general of the State railways, Santiago, Chili.

BIG FRENCH ELECTRICAL ESTABLISHMENT.—Special Consular Agent Godfrey L. Carden, writing from Paris, describes the equipment and character of work done at one of the great French electrical factories. "The Thomson-Houston electrical establishment," says he in his report, "is working at present over 750 persons in its Paris shops. Of this number about 60 are women and girls. One year ago the force employed approximated 1000. The present reduction is in keeping with the general state of the electrical trade at present in France. At its branch shops at Neuilly-sur-Marne the firm is employing about 200 persons in the manufacture of small dynamos and motors, both direct and alternating current, up to about 30 hp. This firm has another large plant started at Lesquin, near Lille, in the north of France, equipped especially for the manufacture of the Curtis turbo-generator sets and all large electrical units. The force employed there at present is about 100 persons. A visit to the Thomson-Houston Paris shops disclosed that practically every form of electric equipment is manufactured. The work turned out is of very high character and necessitates the use of the most modern and accurate machine tools. Practically all the drive in the Thomson-Houston shops is electric. In many cases the tools are independently driven by motors directly attached. I observed a large Curtis turbine in process of construction, the last to be completed in the Thomson-Houston works, by whom the Curtis turbine is being pushed in French territory. Its competitors are the Zoelly, the Parsons and Rateau. All kinds and capacity of electrical equipment and apparatus are made at the Thomson-Houston works, which are equipped for turning out units up to 5000-kw capacity."

SIDEDOOR SUBWAY CARS ORDERED.—The Public Service Commission of the First District of New York has ordered the Interborough Rapid Transit Company to put in operation in the subway 16 cars constructed with side doors according to specifications prepared by Bion J. Arnold. These cars have side doors at the ends of the car and not in the middle and are intended to save delay by allowing entrance and exit at the same time. The work must be done by Oct. 15. The idea is two equip two eight-car trains to be used experimentally. It is estimated by the company that the cost of putting the side doors in the steel cars will be $2,000 for each car and $1,500 each for the composite cars. The cost to the company to reconstruct all of its subway equipment would be approximately $1,500,000. It is likely that this outlay will be spread over a considerable length of time.

BAD PACKING IN BRAZILIAN SHIPMENTS.—Consul-General George E. Anderson, at Rio de Janeiro, writes of the inefficient methods of American packing for foreign shipments. Speaking of the carelessness of Americans, he says: "The necessity of following all shipping directions and of conforming to all legal requirements of consular and other invoicing before the goods leave the United States cannot be too strongly impressed upon American exporters. The failure to properly meet all such requirements not only is embarrassing to the consignee and may mean a great delay in obtaining his goods, which in the meanwhile may be spoiling in the custom house in a hot, damp climate, but is likely to have financial results of a very unsatisfactory sort, the custom house fines and penalties in Brazil and many other countries being severe."

NEW ELECTRIC RAILWAY PROJECTED IN JAPAN.—Consul-General H. B. Miller, of Yokohama, Japan, reports that it is announced that the Department of Communications has granted a charter to the Muhashi Electric Railway Company to build a line from Tengen-ji Bridge, in the Iliro-o suburb of Tokio, direct to Hiranuma, with branch lines to Chofu-mura and Kamada. It is stated that the line will be built in accordance with the private railway law, and that consequently it will be planned on a much larger system than that followed in the case of ordinary electric railways.

CROCKER-WHEELER OFFICERS.—The following officers of the Crocker-Wheeler Company, Ampere, N. J., were elected July 10: President, S. S. Wheeler; first vice-president, Gano Dunn; second vice-president, A. L. Doremus; chief engineer, Gano Dunn; secretary, Rodman Gilder; treasurer, W. L. Brownell; assistant secretary, J. B. Milliken; assistant treasurer, G. W. Bower.

BARSTOW EQUIPMENT ORDER.—W. S. Barstow & Company have recently awarded to the Niles Manufacturing Company, of Niles, Ohio, the contract for six interurban passenger cars and two express cars, to be used on the system of the Oregon Electric Railway Company, Portland, Ore.

THREAD MILLS TO USE ELECTRICITY.—The J. & P. Coats Thread Mills, at Pawtucket, R. I., have supplanted steam by electric power in all their plants. The electric operation was begun on July 6.

Financial Intelligence.

THE WEEK IN WALL STREET.

Wall Street had somewhat more life during the week ended July 13 than during any of the few immediately preceding it. Not only was there more interest in the dealing, but the sales averaged more than 500,000 shares daily, and that fact alone brought returning hope to the discouraged traders. Prices, too, advanced, which was of course to be expected when buyers returned to the market. The net changes for the week were almost altogether advances, and in many instances very fair gains were made considering that the volume of trading was what would have been called "limited" in the days when Wall Street was in reality an active market. American Smelting & Refining common; Chicago, Milwaukee & St. Paul common; Northern Pacific, Reading, Union Pacific and Steel common were the leaders in the activity and each of them recorded a creditable advance. The prevailing opinion fixes politics and the crops as the factors that stimulated the market into a semblance of activity. With the political situation Wall Street seems well pleased. The nomination of Mr. Taft was particularly acceptable to those who view Republican success as essential to the return of prosperity, because he is regarded as the strongest choice that could have been made; the nomination of Mr. Bryan by the Democrats was equally pleasing to these same cheerful people because they believe that no other man could be so easily defeated. It must be remembered, however, that it is almost four months until election and that the Wall Street trader studies the political clouds with more timid uncertainty as to their portent than does the Kansas farmer in the "tornado season." The political seers of the street now predict with confidence the overwhelming defeat of Bryan in November, but

NEW YORK.

	July 6.	July 13.	Shares Sold.		July 6.	July 13.	Shares Sold.
All.-Ch.	11½	11¼	2,700	Int.-Met., com..	11¾	11	1,710
All.-Ch., pfd...	35⅛	34⅜	2,000	Int.-Met., pfd..	31¼	30½	4,500
Amal. Cop.....	68	69¼	145,930	Mackay Cos....	65	64⅛	100
Am. D. T.....	39*	39*	———	Mackay Cos., pfd	65¾*	65¾	100
Am. Loc.....	49½	49¾	15,700	Met. St. Ry....	25*	25*	———
Am. Loc., pfd..	101¼	101¾	1,800	N.Y.& N.J.Tel	107½	107½	15
Am. Tel. & Cbl.	64½	64½*	———	Steel, com.....	38¾	40⅜	351,190
Am. T. & T....	115½	115⅞	2,510	Steel, pfd.....	104⅝	107½	59,884
B. R. T.....	49	49¼	30,505	W. U. T.....	54½	55¼	700
Gen. Elec.....	134	136¼	1,618	West'h, com....	55⅜	55⅛	6,720
Hud. R. Tel...	—	—	———	West'h, pfd....	79	84	600

PHILADELPHIA.

	July 6.	July 13.	Shares Sold.		July 6.	July 13.	Shares Sold.
Am. Rys.....	44⅜	44¼	———	Phila. Elec.....	9⅜	9⅝	———
Elec. Co. of A..	10¾	10⅞	———	Phila. R. T....	17⅛	15⅛	———
Elec. Stor. B'ty.	32	32	———	Phila. Traction..	88	—	———
E. S. B'ty, pfd.	49*	49*	———				

CHICAGO.

	July 6.	July 13.	Shares Sold.		July 6.	July 13.	Shares Sold.
Chi. City Ry...	190*	190*	———	Met. El., com..	17*	16	———
Com. Edison....	100¼	104½	———	Met. El., pfd...	50*	50*	———
Chi. Subway....	18½	18½*	———	Nat'nal Carbon.	70½*	69½	———
Chi. Tel. Co....	135½	139	———	Nat. Carb., pfd.	112*	112*	———

BOSTON.

	July 6.	July 13.	Shares Sold.		July 6.	July 13.	Shares Sold.
Am. Tel. & Tel.	116¼	116¼	———	Mass. E. R., pfd.	46½*	46½*	———
Comb'ind Tel...	108¾	109½	———	Mex. Tel., pfd..	—	—	———
Edison El. Ill...	—	214	———	N. E. Tel'p....	112	113	———
Gen. Elec.....	134	137	———	W. Tel. & Tel..	6*	5⅞	———
Mass. Elec. Ry..	10	9½	———	W. T. & T., pfd.	65	—	———

*Last price quoted.
Shares sold are for week July 6 to July 13.

they will not pin too heavy a financial faith to their expressed conviction. In other words, there will be many anxious moments for the professional traders between now and election, and a pronounced upward movement need not be anticipated immediately. The crop report, the other topic of conversation in the street, was regarded as entirely satisfactory. A large increase in the harvest returns, in wheat, corn and oats was promised, and yet there was no indication that the crop would be so unusual that a serious relapse in prices might be anticipated. Such a condition is all that could be desired for good trade and general prosperity. It is the general impression that stocks on the retailers and jobbers' shelves are almost unprecedentedly small, and with the farmer well supplied with money there must necessarily be an active replenishing all around. Another feature that helped stimulate confidence during the week under review was the declaration by the directors of the Baltimore & Ohio Railroad of the regular 3 per cent semi-annual dividend. The vast decrease in the earnings of this company had led to the very general expectation that the rate would either be cut or the payment passed altogether. The fact that the directors admitted that in order to make the payment it was necessary to take $1,300,000 from the surplus only in a slight degree modified the good impression the payment made, for it was understood that the surplus was amply large to stand the drain without risk to the company and also that the directors would not have taken this step had they not felt amply confident of the speedy return of normal conditions. Money continues very easy, with the demand for accommodations perhaps a trifle more active than for the past two months. The call by the Secretary of the Treasury for $45,000,000 of government funds deposited in national banks caused no disturbance to the financial institutions. Such calls are made, as a rule, only when treasury disbursements must be made, and of course the currency is speedily put back into the channels of trade. On July 13, call loans were quoted at 1 to 1½ per cent, while 90-day paper was selling at 2 to 2¼ per cent. The prices quoted in the table are the closing figures July 13:

DIVIDENDS.

New Orleans City Railroad Company, annual, 1 per cent on common; semi-annual, 2½ per cent on preferred, payable July 10.

National Carbon Company, quarterly, 1 per cent, payable July 15.

Lowell (Mass.) Electric Light Corporation, quarterly, 2 per cent, payable Aug. 1.

American Light & Traction Company, quarterly, 1½ per cent on preferred, 1¾ per cent on common, payable Aug. 1.

Milwaukee (Wis.) Electric Railway & Light Company, quarterly, 1½ per cent on preferred, payable July 31.

Consolidated Traction Company, of Newark, N. J., semi-annual, 2 per cent, payable July 15.

City Passenger Railway Company, Philadelphia, semi-annual, 7½ per cent, payable July 10.

Electric Company of America, Philadelphia, semi-annual, 3½ per cent, payable Aug. 3.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable July 15.

Havana Electric Railway Company, 1½ per cent on preferred, payable Aug. 15.

East St. Louis & Suburban Company, quarterly, 1¼ per cent on preferred, payable Aug. 1.

Omaha (Neb.) Electric Light & Power Company, semi-annual, 2½ per cent, payable Aug. 1.

Manhattan Electric Supply Company, New York, semi-annual, 3 per cent on both preferred and common, payable Aug. 3.

Electric Bond & Share Company, New York, quarterly, 1¼ per cent on preferred, payable Aug. 1.

Grand Rapids Railway Company, quarterly, 1¼ per cent on preferred, payable Aug. 1.

United Traction Company, Pittsburg, semi-annual, 2½ per cent on preferred, payable July 20.

International Steam Pump Company, quarterly, 1½ per cent on preferred, payable Aug. 1.

Jacksonville (Fla.) Electric Company, semi-annual, 3 per cent on preferred; 3 per cent on common, payable Aug. 1.

CHICAGO CITY RAILWAY IMPROVEMENTS.—Half of the improvement work for 1908 scheduled by the Chicago City Railway Company has been completed. The total work planned for the year was the rehabilitation of 53 miles of single track and the building of six miles of extensions. Reconstruction work is now progressing on 10 streets and conduits are being constructed in four streets. Last year the company completed 31¼ miles of new track.

NORTHERN OHIO TRACTION & LIGHT COMPANY.—The Northern Ohio Traction & Light Company, of Akron, Ohio, makes the following report for the month of May and for the five months ending May 31: Gross earnings for May, 1908, were $158,409, as compared with $158,288 for May, 1907. For the five months ending May 31, 1908, gross earnings were $664,298; for the corresponding period in 1907 they were $667,014.

AMERICAN LIGHT & TRACTION RAISES DIVIDEND.—The directors of the American Light & Traction Company at their July meeting voted to increase the rate of dividend on the common stock from a 6 to a 7 per cent basis. A quarterly payment of 1¾ per cent was declared. This dividend rate was increased from 4 to 5 per cent in August, 1906, and from 5 to 6 per cent in August, 1907.

APPEALS TO WESTINGHOUSE STOCKHOLDERS.—While the success of the plan suggested by the merchandise creditors of the Westinghouse Electric & Manufacturing Company is practically assured, the committees that have charge of the readjustment work have felt it necessary to issue additional circulars urging subscriptions to the assenting stock. The merchandise creditors' committee, of which Joseph W. Marsh is chairman, says: "Your committee is gratified to be able to report that 95 per cent in amount of all the merchandise creditors have assented to the merchandise creditors' plan, and that it is confidently expected to secure the assent of the major part if not all of the remaining merchandise claims. Substantial progress has been made toward securing from stockholders, employees and others the $6,000,000 of cash subscriptions to 'assenting stock' required by the plan; and additional subscriptions for a considerable sum are assured, conditioned upon the subscribers being able to make satisfactory financial arrangements therefor. It is, however, still necessary to secure the remaining cash subscriptions as well as the assents from the remaining merchandise creditors. We are unwilling to believe that the few remaining individuals and firms whose consent and assistance are still needed will wish to assume the responsibility for a failure of this effort, when, with their co-operation, the success of the merchandise creditors' plan and the discharge of the receivers are assured." The stockholders' committee, of which Alvin W. Krech is chairman, has sent an appeal to every stockholder of the company who has not subscribed, giving particulars of the success of the plan so far and urging immediate response. This circular says in effect: "The subscriptions reported included subscriptions by about 5000 employees of the company for about $600,000 of stock. The amounts subscribed by the stockholders, other than the Security Investment Company, aggregate $2,214,300, which is very much less than their full quota. The subscriptions by the Security Investment Company are conditioned upon the consummation of the plan. While very encouraging progress has been made, a large amount of additional subscriptions are necessary for the success of the merchandise creditors' plan. Unless these subscriptions are forthcoming, the plan will fail and the benefit of the work done will be lost. In view of the willingness of the employees of the company to subscribe from their savings for about $600,000 of stock, and the willingness of the merchandise creditors with practical unanimity to accept 'assenting stock' in full payment of their claims, the stockholders of the company should certainly protect their property by subscribing for their share of the new stock."

AMERICAN TELEPHONE & TELEGRAPH FINANCES.—One of the significant features of the report of the American Telephone & Telegraph Company is that for the five months ended May 31 the net earnings showed marked increase. The net balance available for dividends for the first five months of the year was equal to 5.27 per cent, as against 5.25 per cent in 1907, on $21,000,000 less capitalization. The condition of the company is thus summarized in the report: "The current year will be one of greatly decreased figures on the score of new construction and extensions. In the last eight years nearly $352,000,000 was devoted to this purpose. The tendency to let up in expansion began early last year when the expenditures for new construction on the part of the Bell system was $30,000,000 less than in 1906. Maintenance allowances, the most vital factor in the telephone situation, continue on a liberal scale and at practically unchanged figures. In 1906 the ratio of maintenance to gross earnings was 29 per cent; in 1907 it was 28.7 per cent. Financial requirements have been satisfied till January, 1909, and, if necessary, it is stated that no new funding operations will be needed till 1910, when the company's note issue of $25,000,000 will come due. What is of great significance, the investment merits of the company's securities have been genuinely recognized by England and the Continent. Foreign bankers hold at least 25 per cent of the large issue of convertible 4s."

AMALGAMATED COPPER COMPANY DIVIDEND.—The directors of the Amalgamated Copper Company are to meet July 16 for the purpose of considering the dividend question. No change in the rate is expected. A prominent copper dealer said: "When the local demand for copper does come, it will come with a rush, and prices, I am afraid, will advance rapidly. This is what the consumer should fortify himself against. We know that it will not be a great while before the large consumers will begin to lay in future supplies. There are no stocks of copper on hand in this country. There are stocks of copper abroad, but the bulk of such stocks is held by the consumers who do not care to sell. When the consuming companies of this country get up to a basis of 60 per cent of their capacity, then you can look for a sharp advance in copper prices."

REFUSE TO PAY HIGH RENTAL.—Adrian H. Joline and Douglass Robinson, receivers for the New York City Railway Company, have cut off the 15 per cent dividend which was paid on the stock of the Central Crosstown Railway Company under the terms of the lease by which that road was operated. The receivers say that the road is not earning the dividend and that while they are willing to continue the operation of the road and meet the fixed charges of the company, they will not pay what is considered an extravagant rental. The Central Crosstown company's tracks run from Twenty-third Street and East River to the Christopher Street Ferry on the Hudson River.

WANTS SECURITIES ORDER MODIFIED. — The Rochester, Corning & Elmira Traction Company, Rochester, N. Y., has applied to the Public Service Commission of the Second District of New York to modify its order that the entire capital stock of the company must be subscribed for at par before any bonds may be issued. The company sets forth that because no part of its road is as yet complete or in operation it is impossible to obtain subscriptions for its entire capital stock at par. The company wants to build its road in two sections, paying for each as it goes.

BOSTON & WORCESTER NOTES AUTHORIZED.—The stockholders of the Boston & Worcester Electric Companies met July 15 for the purpose of authorizing an issue of $600,000, three-year, 6 per cent notes, to be secured by a deposit of a majority of the stock of the Boston & Worcester Street Railway Company. It is the intention of the company to sell approximately $300,000 at the present time for the purpose of paying for the extensions of the line into Natick and for double-tracking the main line from Southboro to Framingham railroad station, and for the payment for equipment and car houses.

PHILADELPHIA RAPID TRANSIT.—Preliminary figures for the fiscal year of the Philadelphia Rapid Transit Company, ended June 30, 1908, show gross earnings of $18,288,000, an increase of $132,500 over the previous year. Although the official figures of the net earnings have not been made up as yet, it is reported that operating expenses increased about 10 per cent over the previous year, in which case they amounted to approximately $11,000,000. On this basis net earnings were about $7,228,000, comparing with $8,049,016 in the previous year, a decrease of about 11.3 per cent.

PLAN TO BUILD TWIN CITY SUBWAY.—The Twin City Underground & Elevated Electric Railway Company has recently been incorporated at Minneapolis, Minn., with a nominal capital of $50,000. It announces its purpose to build a subway connecting Minneapolis and St. Paul at a cost of $6,000,000 to $7,000,000. The Minneapolis and St. Paul aldermanic boards will be asked to grant franchises. The incorporators are: George B. Norris, William G. Stewart and Jay W. Crane.

JOHNSTOWN (PA.) UTILITIES WILL NOT MERGE.—The stockholders of the Citizens' Light, Heat & Power Company, of Johnstown, Pa., have refused to accept par for their stock from Emmett Queen and James M. Guffey, of Pittsburg, who were endeavoring to form a merger of all the utilities companies in Johnstown. This refusal to sell on the part of the principal light and power concern effectually puts a stop to all efforts to form a merger for the present.

CONSOLIDATED GAS SELLS NOTES.—N. W. Harris & Company, New York, have purchased from the Consolidated Gas Company an issue of $5,000,000 5 per cent collateral trust notes, payable Aug. 10, 1909. These notes were issued for the purpose of providing funds to retire the same amount of 6 per cent notes due Aug. 10, 1908. The notes are secured by the deposit of stock of the New York Edison Company.

TO TEST RIGHT TO REDUCE FARES.—The Delaware & Hudson Company has determined to test the right of the Public Service Commission of the Second District of New York to reduce fares on the United Traction Company's lines between Albany and Watervliet from 10 to 5 cents. The traction company is controlled by the Delaware & Hudson Company.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

BIRMINGHAM, ALA.—It is reported that the Birmingham Railway, Light & Power Company will extend its railway from the plant of the United States Cast Iron Pipe Company, Bessemer, via Dolomite to Wylam. G. H. Harris is manager.

COLUMBIA, ALA.—The Columbia Electric Light & Water Company is planning to develop a water power and extend its transmission lines. D. R. Bragnuier is manager.

HUNTSVILLE, ALA.—E. L. Pulley is interested in a project to build an electric railway to the fair grounds through South Huntsville, which will be operated under the name Huntsville & Chattanooga Electric Railway & Power Company. The company will soon be incorporated with a capital stock of $50,000. A temporary electric power plant will be erected near the fair grounds, but the company plans to develop the water power of the Tennessee River for future use. It is expected that the railway will be extended to Birmingham or Chattanooga within a year of two.

HOLBROOK, ARIZ.—Surveys are now being made for the proposed railway between Holbrook and Fort Apache, Ariz., a distance of 100 miles, to be built by the Navajo Improvement Company, contracts for the construction of which will be let about Oct. 1. The road will be operated by steam or electricity. E. S. Campbell, of Prescott, Ariz., is president.

PARIS, ARK.—It is expected that work on the construction of the Paris & Subiaco Traction Company's proposed electric railway will begin in September. The road will be six miles in length. An extension may be built later to the mines of the Southside Anthracite Coal Company, a distance of eight miles. D. J. Young, of Fort Smith, Ark., is one of the incorporators.

CORONA, CAL.—The water rights of Lake Elsinore have been purchased by George I. Lamy, of Los Angeles. It is proposed to convey the water from Lake Elsinore to the Santa Ana River, 35 miles distant, by means of a flume, where a power house will be erected. By this means a drop of 740 ft. will be obtained, and it is estimated that 3000 hp can be developed. The cost of the work is estimated at $500,000.

MERCED, CAL.—The Board of Supervisors has granted a franchise to W. E. Mitchell and others to construct a private telephone line along the Merced and Turlock Road.

REDDING, CAL.—Notice of appropriation of 5000 cu. in. of the water of Bear Creek in this county has been filed by H. Shannon. The water is to be used for irrigation, domestic purposes and for the generation of electricity.

SAN FRANCISCO, CAL.—The United Railroads has applied for permission to rebuild the power house at the corner of Beach and Buchanan Streets. The cost of the work is estimated at $63,000.

SANTA ROSA, CAL.—Bids will be received at the office of the supervising architect, Washington, D. C., until Aug. 27 for the construction of the U. S. post office building at Santa Rosa, Cal., including heating apparatus, electric conduits and wiring, gas piping, etc., plans and specifications for which can be obtained at the above office or at the office of the custodian of the site at Santa Rosa, Cal. James Knox Taylor is supervising architect.

DENVER, COL.—The plant of the Flint-Lomax Electric & Manufacturing Company was recently destroyed by fire, causing a loss of about $50,000.

GREELEY, COLO.—D. A. Canfield is reported to be interested in the construction of an electric railway from Greeley to Pleasant Valley.

DANBURY, CONN.—The Danbury & Bethel Gas & Electric Light Company has extended its lighting service to Wooster Heights to furnish electricity for lamps to the residents of that section.

WILLIMANTIC, CONN.—The American Thread Company is making arrangements to increase its power plant, including the installation of a new engine from 1300 to 1800 hp, five 200-hp Manning boilers, in addition to the nine already installed. A 475-kw generator is to be installed in the basement of Mill No. 2.

WASHINGTON, D. C.—Bids will be received until July 28 at the Bureau of Supplies and Accounts for furnisking supplies at the navy yard, Puget Sound, Wash., as follows: Schedule 48—Miscellaneous electrical supplies; Schedule 50—2600 incandescent lamps. Applications for proposals should designate the schedule by number. E. B. Rogers is Paymaster General, U. S. N.

WASHINGTON, D. C.—Bids will be received until Aug 6 at the office of the constructing quartermaster of the Walter Reed General Hospital, Takoma Substation, Washington, D. C., for the construction of one double set of hospital corps sergeants' quarters at the above hospital, including electric wiring and electric fixtures, gas piping, etc. A deposit of $25 will be required for drawing and specifications, which will be returned to bidder on return of drawings. Captain H. L. Pettus is quartermaster.

LEESBURG, FLA.—Application has been made to the town by Gilbert Hunter, of Jacksonville, for an electric light and water franchise.

AMERICUS, GA.—It is reported that the Americus Railways & Light Company will take over the water, gas and electric light plans by July 15, after which work will commence on the street railway system.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company is planning to increase the equipment of the Augusta power house and will install a 260-kw generator. The company proposes to expend about $25,000 for improvements to the local plant.

AUGUSTA, GA.—J. L. Hankinson and P. Wood are interested in a project to furnish electricity for commercial and industrial purposes in Augusta, also the construction of a power plant and dam about eight miles from Augusta. Preliminary surveys and arrangements are now being made.

FITZGERALD, GA.—The Fitzgerald & Ocilla Electric Railway & Power Company has increased its capital stock to $100,000 and has authorized an issue of $250,000 in bonds for the construction, equipment and improvement of its road.

HARLEM, GA.—The Columbia County Cottonseed Oil Company is planning to install an electric light plant in connection with its cottonseed oil mill. Hugh S. Paschal is secretary.

SANDERSVILLE, GA.—The citizens of Sandersville and Tennille, Ga., are interested in establishing an electric railway between the two towns, a distance of three miles, and would like to communicate with representatives of reputable electric companies with a view of constructing the railway and also taking some stock in the corporation. Both towns are lighted from the Sanderville electric plant and water facilities are at hand for developing electricity. For further information address J. E. Johnson, secretary.

VOLLMER, IDAHO.—Work has commenced on the construction of the electric light plant and water works system. A steam plant will be installed to generate electricity, which will be used to light the streets of the city and for domestic and commercial purposes.

AURORA, ILL.—The property of the Aurora, De Kalb & Rockford Electric Traction Company is to be sold at auction in Chicago on July 21 to satisfy claims against the company.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, until July 20 for the construction of a three-duct conduit system in Euclid avenue from Seventy-first street to Seventy-third street, and about 125 ft. in Seventy-first and Seventy-third streets.

CHICAGO, ILL.—John H. Brennan, attorney for the Illinois Central Railroad, announces that the company proposes to substitute electricity for steam power on all of its suburban trains and has asked for permits to enable the Kensington & Eastern Railroad to cross certain streets in the city. The latter road is to be feeder of the Illinois Central Railroad.

DANVILLE, ILL.—It is reported that the electric railway from Paris to Chrisman is practically assured and will be financed by Chicago capitalists. The railway will be an extension of the Indianapolis, Terre Haute & Western Traction Company.

MURPHYSBORO, ILL.—Plans are being considered for the construction of a power plant and a street railway about two miles in length. The new company has been granted a franchise from the city and will take over the old mule car line now in operation and install electric service.

SPRINGFIELD, ILL.—The Springfield Light, Heat & Power Company is planning to enlarge its power house to provide space for two McNall type boilers of 500 hp each.

BEDFORD, IND.—Bids will be received at the office of the supervising architect, Washington, D. C., until Aug. 11 for the construction of U. S. post office building at Bedford, Ind., including heating apparatus, electric conduits and wiring, gas piping, etc. Plans and specifications may be obtained at the above office or at the office of the custodian of the site at Bedford. James Knox Taylor is supervising architect.

COLUMBUS, IND.—The Central Indiana Lighting Company is contemplating rebuilding its entire plant, which may possibly be done this season. William C. Pratt is vice-president.

FOWLER, IND.—The Fowler Utilities Company, a corporation supplying light, water and heat for the town, which went into the hands of a receiver four months ago, is about to be shut down, under orders of the court. B. M. McBride, receiver, says that the most economic management of the operating expenses leaves a deficiency of about $500 per month. The loss is said to be due to waste on the part of the consumers, who take service on a flat rate instead of by meter.

FRANKFORT, IND.—The Commissioners of Clinton County have ordered special elections to be held in Ross and Center Townships Aug. 11 to vote on the proposition of a subsidy tax of $15,000 and $50,000, respectively, in aid of the construction of the Frankfort & Delphi Electric Railway.

GOSHEN, IND.—The Winona Interurban Railway Company is contemplating the construction of a branch line from Milford to Nappanee,

the cost of which is estimated at about $200,000. The company has sufficient power and rolling stock to operate the extension.

LIGONIER, IND.—The City Council has awarded a contract for the construction and equipment of a municipal electric light plant to the C. L. Olds Construction Company, of Ft. Wayne. The city has made an appropriation of $60,000 to pay for the plant.

RICHMOND, IND.—The City Council has granted a franchise to the Dayton & Western Traction Company to operate its cars in Richmond.

SEYMOUR, IND.—The Indianapolis, Columbus & Southern Traction Company is rebuilding one of its engines at the Edinburg power plant and installing a direct-connected 1000-kw generator to take the place of the 500-kw unit which has been in use. The generator was purchased from the Allis-Chalmers Company, and the engine is being rebuilt by the Buckeye Engine Company, of Salem, Mass. A. A. Anderson is general manager.

COLFAX, IA.—James P. Donahue is reported to have been granted a franchise to construct an electric railway in Colfax.

SAC CITY, IA.—The Greene County Telephone Company is considering the question of placing its wires underground in this city.

STORY CITY, IA.—The local telephone company is planning to place its wires in underground conduits in this city.

LINWOOD, KAN.—The citizens have voted to issue $40,000 in bonds for the construction of an electric light plant and water works system.

WICHITA, KAN.—Plans have been completed for the construction of a new power plant for Fairmount College, the cost of which is estimated at $5,000. A new boiler of 100 hp will be installed in addition to the one now in service.

LEXINGTON, KY.—The Central Kentucky Traction Company is planning to construct an extension from Lexington to Nicholasville, along the Nicholasville Pike. The above company is owned and operated by the Lexington & Interurban Railways Company. J. B. Crawford is general manager.

MAYFIELD, KY.—The Mayfield Water & Light Company is making arrangements to install additional machinery in its plant which was recently damaged by lightning and will purchase one 300-kw and one 500-kw, 2300-volt, 60-cycle, three-phase alternators direct connected to cross-compound non-condensing engines operating at 150 r.p.m. W. E. Playter is engineer.

NEWPORT, KY.—Bids will be received by John W. Davis, city clerk, for a telephone and telegraph franchise. The franchise is for a term of 20 years.

RUSTON, LA.—The North Louisiana Telephone Company contemplates the construction of a telephone line from Ruston to El Dorado; also to erect a long-distance line from Ruston to Little Rock, Ark.

BALTIMORE, MD.—Announcement has been made that work will soon commence on the construction of the proposed electric railway of the Baltimore, Halethorpe & Elkridge Railway Company. The road will extend from Baltimore to Elkridge and it is hoped to have the road in operation as far as Halethorpe this fall. It is said that the Maryland Electric Railways Company will aid in the building and will operate the road when completed.

FREDERICK, MD.—Negotiations have been completed for the purchase of the Monocacy Valley Railroad by the Washington, Frederick & Gettysburg Railroad Company. It is understood that the Monocacy Valley Railroad Company will not for the present be absorbed by the Washington & Gettysburg Railroad Company, but will continue as a separate company, and will be leased and operated by the latter company. The connecting link between the two railways will be completed by the middle of September, the contract for which has been awarded to J. E. McDonald & Company, of Frederick.

LAUREL, MD.—Charles L. Reeder, Equitable Building, Baltimore, Md., has been engaged by the city to have charge of the construction of the municipal electric light plant, for which $15,000 in bonds was recently voted.

BOSTON, MASS.—Extensive improvements are contemplated by the Boston & Worcester Companies, which include the extension of the railway into Natick, double-tracking the main line from Southboro to Framingham railroad station, and for new equipment and car houses.

DANVERS, MASS.—The citizens have authorized the town treasurer to issue $11,000 in bonds, the proceeds to be used for improvements and additions to the municipal electric light plant as follows; A 300-hp slow-speed compound Corliss steam engine at a cost of $8,000; a new boiler to cost $1,500; for a spur track at the station $500, and $1,000 for the extension of domestic and commercial service.

OAK BLUFFS, MASS.—The State Board of Gas and Electricity has granted the Vineyard Haven Gas & Electric Company permission to issue 50 additional shares of capital stock to be offered to stockholders at par value of $100, the proceeds to be used to cancel outstanding obligations incurred for improvements and extensions of the plant.

WRENTHAM, MASS.—Bids will be received by the trustees of the Wrentham State School until July 23 for the erection of a service building and two dormitories and for boilers, stack, piping and heating plant and for electric plant, wiring and equipment. Plans and specifications may be seen at the office of Kendall, Taylor & Co., 93 Federal Street, Boston, Mass. Albert L. Harwood is chairman of trustees.

GRAND BLANC, MICH.—The Grand Blanc Telephone Company contemplates extending its telephone lines in the farming districts east of the city.

LANSING, MICH.—The Michigan United Railway Company has filed a mortgage at Marshall, Mich., in favor of the Knickerbocker Trust Company, of New York, N. Y., as trustee, to secure an issue of $12,500,000 in bonds.

MARQUETTE, MICH.—The Marquette, Negaunee & Ishpeming Interurban Railway Company has authorized an issue of $400,000 in bonds, the proceeds to be used for the construction of its proposed electric railway to connect Marquette, Negaunee and Ishpeming.

MONROE, MICH.—The City Council has granted a franchise to Toledo, Ottawa Beach & Northern Railway to construct and operate a street railway through the city. The railway is owned by the Toledo Railways & Light Company, and is now completed to Toledo Beach, six miles south of Monroe. It is proposed to extend the line to Detroit as soon as possible.

MUSKEGON, MICH.—The contract for the construction of the electric railway between Grand Rapids and Ludington has been awarded to the National Construction Company, of Chicago, Ill. The railway will cost about $750,000 and will be completed about the first of next year.

OWOSSO, MICH.—The Owosso & Corunna Electric Company contemplates extending its railway from Corunna to Durand, a distance of nine miles, in the near future. L. Manning is general manager.

TRAVERSE CITY, MICH.—Plans are being considered by the Michigan State Telephone Company for the erection of about 70 miles of telephone lines between Traverse City and Manistee.

WOLVERINE, MICH.—The Northwestern Telephone & Telegraph Company contemplates extending its telephone system from Wolverine to Cheboygan, to secure direct connection with Alpena, Bay City and other points.

WYANDOTTE, MICH.—The Board of Public Works has decided to reduce the price of electricity for lamps and motors, and to change the street lighting service from midnight to an all-night schedule. The new schedule of rates is to take effect Aug. 1 as follows: Six cents per kw-hour for the first 50 kw-hours; five cents per kw-hour for the next 50 kw-hours, and four cents for all above 100 kw-hours. Electricity for motors will be charged at the rate of five cents per kw-hour for the first 20 kw-hours for each horse-power installed, decreasing to two cents for 300 kw-hours or more. Five per cent will be added to all bills not paid before the 15th of the month.

ALEXANDRIA, MINN.—Bids will be received until July 17 by the Village Council for furnishing mechanical and electrical equipment and the building required in the reconstruction of the electric light and water works plant and system, the cost of which is estimated at $20,000. Edwin P. Burch, Guaranty Building, Minneapolis, is engineer.

ST. CLOUD, MINN.—The Union Power Company, recently organized, proposes to build an electric light and power plant in this city. It is said that the company will not operate the plant, but will lease it to the Public Service Company, which controls the entire electric field in St. Cloud. Power for operating the plant will be furnished by the St. Cloud Water Power Company. The company is capitalized at $100,000.

VINELAND, MINN.—Plans are being considered for the construction of an electric railway between Vineland and Onamia. A. P. Jorgensen, William Anderson, E. E. Dinwiddie and John Faught are interested in the project.

ST. JOSEPH, MO.—At the election to be held August 8 the citizens will vote on the proposition to issue $15,000 in bonds for laying conduits and lighting the "Great White Way."

ST. LOUIS, MO.—The St. Louis, Lakewood & Grant Park Railway Company contemplates placing contracts for the construction of 1¼ miles additional track in the near future.

OMAHA, NEB.—C. C. Shimer has applied for a franchise to operate a street railway between South Omaha and Seymour Park.

OMAHA, NEB.—The Omaha & Nebraska Central Railway Company, which is building an electric railway from Omaha to Hastings, has decided to abandon the third-rail and adopt the overhead trolley system. C. H. Deeter, of Omaha, is secretary.

SPRINGDALE, NEV.—T. R. Rankin, of Los Angeles, Cal., is interested in a project to install an electric light and gas plant in Springdale.

BELLEVILLE, N. J.—Application for a franchise to construct and operate an electric light plant and gas works has been made to the Township Committee by the Oaks Land & Improvement Company. George Francis O'Neill, of Newark, is manager of the company.

HIGH BRIDGE, N. J.—The citizens at an election held June 16 defeated the proposition to issue $15,000 in bonds for the construction of an electric light plant. L. W. Dorland is clerk.

MORRISTOWN, N. J.—Negotiations are under way between the Public Service Corporation of New Jersey and the Morris & Somerset Electric Company for the lease of the Public Service Corporation's local plant to the latter company. The Morris & Somerset Company was organized about a year ago and has built a plant at a cost of about $150,000, which has been in operation for several months. With the lease of the Public Service plant the new company would secure the use of the underground and overhead distributing system, and would also succeed to several street lighting contracts in the villages near Morristown.

Samuel S. Childs is president of the Morris & Somerset Electric Company.

PATERSON, N. J.—Plans are being prepared by the New York & North Jersey Rapid Transit Company for the construction of an interurban electric railway between Paterson, N. J., and Suffern, N. Y. M. R. McAdoo, of Paterson, is general manager.

ALBION, N. Y.—After an investigation in regard to complaints made by the citizens in regard to the poor service of the Albion Power Company and the application of the Swett Electric Light & Power Company for a franchise to furnish electric service in Albion, the Public Service Commission of the Second District has given the receiver of the Albion Power Company an opportunity to begin at once certain improvements, to be completed within 30 days and others within 60 days. The application of the Swett Electric Light & Power Company is held open for 30 days. If at the end of that time the improvements required have not been undertaken to the satisfaction of the commission, the application of the Swett company will be taken up. The Albion company is required to rehabilitate its water power plant, make necessary repairs to its boilers and purchase and install a 900-kw belt-driven generator, with other necessary appliances and to erect additional transmission lines necessary to give proper service in Albion. The company is also required to install the following apparatus: Three 500-kw, 6600-13,200-volt transformers, with necessary connections; new arc-lamp system, proper switchboard devices on its entire system, exciter regulators, single-phase feeder regulators.

BABYLON, L. I., N. Y.—The Village Trustees have granted the South Shore Traction Company a franchise to build and operate an electric railway on the streets of the village, in return for which the company agrees to light the streets so used, to sprinkle and pave between the rails with brick on Main Street and part of Cooper Street.

CANTON, N. Y.—The Canton Electric Light & Power Company has been granted authority by the Public Service Commission to issue $16,000 in bonds, the proceeds to be used to increase and improve its service. The company has entered into a contract with the Hannawa Falls Water Power for electrical energy for a term of 20 years, and proposes to equip a substation, substitute new and improved meters and transformers for the ones now in use and to build additional transmission lines.

CHATEAUGAY, N. Y.—The Chateaugay Electric Light & Power Company has applied to the Public Service Commission for permission to transfer its plant and franchise to the Chasm Power Company. The Chateaugay Company states that the Chasm Power Company is ready to purchase the property and will give the village better service than that which can be given by two competing companies.

GENEVA, N. Y.—The City Council will soon advertise for bids for lighting the city for a term of five years.

NIAGARA FALLS, N. Y.—The Canadian Niagara Power Company is erecting another transmission line to Fort Erie to connect with Buffalo. The new line will parallel the present line and will carry 12,500 hp. It is expected to have the line completed by Oct. 1.

ROCHESTER, N. Y.—The Rochester, Corning & Elmira Traction Company has applied to the Public Service Commission to modify its order, requiring that the entire capital stock must be taken before any bonds were issued. The company states that it is not able to comply with the above order as no part of the road is in operation, and asks permission to build and put in operation a portion of its railway from Rochester and Lakeville to Conesus Lake, a distance of 25 miles, the cost of which will be $2,277,000, and later to build from Lakeville to Dansville, an additional 25 miles, at a cost of $1,705,610. The company requests permission to issue $1,000,000 in bonds and $500,000 in capital stock, the proceeds to be used to construct the railway from Rochester and Lakeville to Conesus Lake, and also asks for authority to issue $1,250,000 in bonds. It is the intention of the company to purchase electrical energy to operate the first section and for the second section it will build a power plant to furnish electricity for the entire 50 miles.

SODUS, N. Y.—The Sodus Gas & Electric Light Company is making extensions to its lighting service and is extending its lines to Webster and to Sodus Point, which will involve an expenditure of about $75,000. The company has abandoned its steam plant, which is for sale, and now obtains electrical energy for operating its system from the Rochester Railway & Light Company, through the Sodus substation of the Rochester & Sodus Bay Railway Company. G. R. Mills is secretary.

ASHEVILLE, N. C.—The Weaverville Electric Company is planning to build an electric railway from new Bridge Station on the Asheville Rapid Transit Railway to Weaverville, N. C., a distance of four miles. John H. Carter is president.

DURHAM, N. C.—The Suburban Land & Power Company, recently incorporated, has been organized and the following officers elected: John Sprunt Hill, president; S. W. Minor, vice-president, and I. F. Hill, secretary and treasurer. The company is capitalized at $250,000 and proposes to construct and operate electric light and power plants.

MINOT, N. D.—It is reported that the City Council has decided to operate the city pumping station by electricity.

FREMONT, OHIO.—The Fremont Street Railway has been granted an amended franchise permitting the company to extend its railway and construct a belt around the city.

LIMA, OHIO.—The City Council has rejected the proposition submitted by W. Kesley Schoepf for street lighting and has awarded the recent $80,000 bond issue made for the erection of a municipal electric light plant.

MIAMI, OKLA.—THE Commercial Club is considering the question of building an interurban line from Miami to the mines several miles north of here.

OKEMAH, OKLA.—The citizens have voted to issue $8,000 in bonds to build an electric light plant in Okemah.

OKMULGEE, OKLA.—Bids will be received until July 20 by the City of Okmulgee for a 60-hp gas engine direct connected to a 35-kw generator, or an automatic high-speed engine of the same rating and a triplex pump direct connected to an electric motor, valves and other supplies. Plans may be secured from the O'Neil Engineering Company, of Dallas, Tex.

STILLWATER, OKLA.—The city is planning to make extensions and improvements to the municipal electric light plant, and will soon ask for bids on two generating units alternating-current, direct connected, of 60-kw and 90 kw, respectively.

ASHLAND, ORE.—The Ashland Electric Power & Light Company has issued a new schedule of rates for electricity for lamps to take effect July 20. The new rates are based on 16-cp lamps per month, and 8-cp lamps or less will be charged the same as the 16-cp lamps. At present the 8-cp lamps are rated at two-thirds of 16-cp lamps. Under the new schedule the rates are: For one lamp $1 per month, two lamps $1.25, four $1.40, six $1.70, ten $2.30 and 13 or more 20 cents each.

FOREST GROVE, ORE.—The railroad committee of the Forest Grove Board of Trade has secured pledges of $4,200 for the purchase of the rights of way and terminal grounds for the extension of the Oregon Electric Railway from Hillsboro to this city.

MARSHFIELD, ORE.—The City Council has granted a telephone franchise to R. L. Burett. It is understood that the Home Telephone Company, of Portland, is interested in the project.

PORTLAND, ORE.—The City Council has granted the Mount Hood Railway & Power Company a right of way for an electric railway across the property on Bull Run Reserve, controlled by the city.

WOODBURN, ORE.—Work has commenced on the construction of the proposed electric railway of the Valley Railway Company which is to connect Woodburn and West Woodburn, and thence through Monitor to Scotts Mills, and on up into the foothills to Wilhoit Springs. The railway will be 25 miles in length. Frank Robertson, of Portland, is president.

PANAMA.—Bids will be receied at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Aug. 3 for furnishing the following named articles: Wire, cable, batteries, arc lamps and hoods, etc., as per circular (No. 454); also until Aug. 7 for cableways, as per circular (No. 455). Blanks and general information pertaining to the above circulars may be obtained from the above office or the offices of the assistant purchasing agents, 24 State street, New York, N. Y.; Custom House, New Orleans, La.; 1086 North Point Street, San Francisco, Cal. Also from the U. S. engineer offices in the following cities: Seattle, Wash.; Los Angeles, Cal.; Baltimore, Md.; Philadelphia, Pa.; Pittsburg, Pa.; Boston, Mass.; Buffalo, N. Y.; Cleveland, Ohio; Cincinnati, Ohio; Chicago, Ill.; St. Louis, Mo.; Detroit, Mich.; Milwaukee, Wis.; St. Paul, Minn.; Chattanooga, Tenn.; Louisville, Ky.; Mobile, Ala., and Galveston, Tex.; Business Men's League, Kansas City, Mo.; Chamber of Commerce and Board of Trade, Tacoma, Wash., and Chamber of Commerce, Quincy, Ill.

CHESTER, PA.—The Chester Traction Company will award contracts for the construction of an extension of about 1½ miles within the next two weeks. Arthur G. Jack is superintendent.

GETTYSBURG, PA.—Governor Stuart has approved of the extension of the route of the Mt. Holly & Gettysburg Railway from Hunter's Run to Gettysburg, via Bendersville, Arendtsville, a distance of 23 miles. the road will run almost entirely over private right of way.

JOHNSTOWN, PA.—The Southern Cambria Railway Company has awarded contracts for the installation of all the power house and line equipment to the General Electric Company, of Schenectady, N. Y., to cost about $95,000.

LOCUST GROVE, PA.—The Locust Grove Telephone Company is contemplating making further extensions to its system in the near future.

MONONGAHELA, PA.—The application of the Carlisle, Monongahela & Carroll Street Railway for permission to extend its street railway from Park avenue, Monongahela City, to Bentleyville, Ellsworth and Cokeburg has been approved by Governor Stuart.

NEW CASTLE, PA.—It is reported that New Castle, Butler & Harmony Street Railway Company contemplates the purchase of the Sharpsville Railway. It is operated by the Baltimore & Ohio Railroad, but is now in the hands of a receiver.

PITTSBURG, PA.—Contracts have been awarded by the Pittsburg-Buffalo Coal Company at Mariana, Washington County, to the Westinghouse Electric & Manufacturing Company and other local concerns for machinery and electrical equipment for its plant. The company is to build a new mining town and will expend about $3,000,000.

TACONY, PA.—Plans are being considered by the Holmesburg, Tacony & Frankford Electric Railway Company for enlarging its boiler room and the installation of a 400-hp boiler and an additional feed water pump. Henry Glazier is superintendent.

WEST CHESTER, PA.—The West Chester & Wilmington Street Railway Company has increased its capital stock from $254,000 to $500,000, and has also filed a mortgage of $500,000 to the Security Trust & Safe Deposit Company, of Wilmington, Del., as trustee.

CHARLESTON, S. C.—The capital stock of the Summerville & Charleston Electric Railway Company has been increased from $100,000 to $200,000.

VALLEY CITY, S. D.—H. F. Halverson, city auditor, writes that J. A. Murray, of Wilkes-Barre, Pa., bid $25,000 for a 20-year lease of the municipal electric light plant, payment to be made in service. The bid was rejected and no further bids will be called for.

FORT WORTH, TEX.—The Northern Texas Traction Company has filed amendments to its charter increasing its capital stock from $3,000,000 to $3,500,000.

BROWNWOOD, TEX.—W. S. Walker, of Granbury, has petitioned the Council for a franchise to construct and operate a street railway in Brownwood.

GAINESVILLE, TEX.—The Gainesville, Whitesboro & Sherman Interurban Electric Railway Company has filed a mortgage to secure an issue of $1,000,000 in bonds. John King, of Gainesville, is president of the company.

GERMANTOWN, TEX.—Plans are being made by the independent telephone company, recently formed in this city, for the construction of a telephone line to Fannin, where long distance connections will be established, and also the construction of a telephone line to connect with the Ander telephone system.

MT. PLEASANT, TEX.—The City Council has granted a franchise to H. W. Peterman and associates to construct and operate a street railway system in the city. It is proposed to organize a stock company, with a capital stock of from $50,000 to $60,000, and apply for a charter at once.

BELLINGHAM, WASH.—The Home Telephone Company is extending its telephone lines to Alger, Belfast, Belleville and a number of other places.

DAVENPORT, WASH.—Arrangements are being made by the Big Bend Milling Company to install an electric power plant.

DES MOINES, WASH.—J. C. Elsey has been granted a franchise to install and operate a telephone system in Des Moines.

KELSO, WASH.—The Northwestern Independent Long Distance Telephone Company has applied for a franchise to erect a long-distance telephone line in Kelso.

LEAVENWORTH, WASH.—Plans are being made by the Lamb-Davis Lumber Company for the construction of an electric railway, 25 miles in length, from Leavenworth to Wenatchee.

RALSTON, WASH.—The Washington Water Power Company has entered into a contract with the Ralston Milling Company to furnish electrical energy to operate the mill which the company is constructing in Ralston; also the electric plant, which it is said the milling company will install here.

SEATTLE, WASH.—L. B. Youngs, superintendent of the municipal electric light plant has applied to the City Council for an appropriation of $288,400 for extensions to the plant and city lighting system.

SPOKANE, WASH.—The Board of Public Works has adopted a resolution directing the city engineer to communicate with other cities operating municipal electric light plants, with a view of obtaining information in regard to establishing a municipal electric plant in Spokane. The city now pays about $30,000 per year for lighting service for the city.

TENINO, WASH.—William McArthur, of the Hercules Sandstone Company, has filed a notice of water rights at the upper falls of the Des Chutes River, which he proposes to develop to generate electricity to be used in connection with the quarry. Later he will probably furnish electrical energy in the town of Tenino.

ATHENS, WIS.—The Athens Telephone Company is planning to extend its telephone lines to Frankfort, Gad and Halsey.

WALWORTH, WIS.—H. Windsor, owner of the local electric light plant, is planning to extend the transmission line to Geneva Lake, a distance of about five miles. Electricity for operating the system is purchased from the Chicago, Harvard & Geneva Lake Railway Company.

NELSON, B. C.—Plans are being considered for increasing the equipment of the municipal electric light plant, including the installation of a 100-kw generating unit. R. A. Brown is superintendent.

NEW WESTMINSTER, B. C.—A second dam is to be built at Coquitlam Lake to provide a bigger "head" for the Vancouver Power Company's plant.

VICTORIA, B. C.—It is reported that the Esquimalt Water Company proposes to furnish electricity for lamps and motors in competition with the British Columbia Electric Railway Company. It is understood that the company will apply to the next session of the Provincial Legislature for a charter allowing it to do this.

MERRITTON, ONT., CAN.—The citizens on July 6 voted in favor of the by-law to purchase the local electric light plant to be operated by the municipality for $10,000.

MONTREAL, QUE., CAN.—The City Council has decided to accept the offer of the Canadian Light & Power Company to supply the city with electricity and has granted the company a franchise for a term of 10 years. The new by-law as adopted requires the company to supply 5,000 hp by 1910 and 20,000 hp by 1915 at the following rates: Electricity for incandescent lamps, not to exceed 10 cents per kw-hour, with a cash discount of 5 per cent for payment in 10 days on contracts for a term of one year or over and 10 per cent for payment within 10 days on contracts for five years.

HUMBOLT, SASK., CAN.—The Humbolt Electric Light, Power & Telephone Company has been incorporated with a provincial charter.

PACHUCA, MEX.—The Negociacon Minera de San Rafael Anexas has awarded the Westinghouse Electric & Manufacturing Company a contract for the electrical equipment of its new stamp mill, which includes 40 electric motors, averaging 100 hp each; transformers, high and low tension switchboards, circuit breakers and pumps.

New Industrial Companies.

A. GEOGHAN & SON, of Brooklyn, N. Y., has been incorporated with a capital stock of $15,000, for the purpose of manufacturing electrical machinery. The directors are: Anthony Geoghan, William A. Geoghan and Edward L. Geoghan, of New York, N. Y.

THE SAFETY ELECTRIC OPERATING COMPANY, of Jersey City, N. J., has filed articles of incorporation with a capital stock of $500,000. The incorporators are: H. W. Andrews, G. E. Osborne and Charles D. Montague. The company proposes to operate and deal in motor vehicles.

THE AETNA ELECTRIC COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 by George K. Hamblin, of Metuchen; Edward S. Walsh, of Montclair, N. J., and Robert W. Morgan, of Yonkers, N. Y. The company proposes to manufacture and deal in electric lamps and fixtures.

HICKS MOTOR & MANUFACTURING COMPANY, of Garwood, N. J., has filed articles of incorporation with a capital stock of $25,000 to manufacture dynamos and motors. The incorporators are: Albert B. Craft, of Cranford, N. J.; Harry E. Hicks, of Plainfield, N. J., and William H. Elliott, of Westfield, N. J.

THE GROSS ELECTRIC COMPANY, of Hoboken, N. J., has been incorporated with a capital stock of $25,000 by Henry Wilkens, Charles B. Wilkens and Samuel Gross. The company proposes to do a general electrical and mechanical engineering business. This item was published in the issue of July 11 under the head of the Cross Electric Company.

New Incorporations.

LA GARITA, COL.—The La Garita Telephone Company has been incorporated with a capital stock of $3,000 by C. D. Wadsworth, Michael White and W. E. Gardney, of Center.

CREAL SPRINGS, ILL.—The Creal Springs Mutual Telephone Company has been incorporated with a capital stock stock of $2,500 by H. P. Frick, A. L. Howerton, John Rector and others.

FOLSOMVILLE, IND.—The Folsomville Farmers' Mutual Telephone Company has been organized to install a telephone system in Folsomville and erect a telephone line to Boonville, where connections will be made with the Chandler Telephone Company's system. John W. Roberts is president of the company and L. L. Williams, secretary.

DELPHOS, IA.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company with a capital stock of $1,500.

DES MOINES, IA.—Articles of incorporation have been filed for the Midland Electric Company with a capital stock of $25,000. H. S. J. Towner is president and treasurer, and E. B. Hill vice-president and secretary.

FRANKFORT, KY.—The Trigg County Citizens' Telephone Company has been chartered with a capital stock of $1,000 by E. L. Taylor, A. Holland, C. Mitchell and others.

TOMPKINSVILLE, KY.—The Tompkinsville Home Telephone Company has been incorporated with a capital stock of $6,000 by W. S. Smith, J. E. Leslie, William Webb and others.

Legal.

RECEIVER APPOINTED.—On application of the F. Bissell Company, of Toledo, Ohio, A. N. Doyle has been appointed receiver for the L. W. Gillespie Company, of Marion, Ind. The company is the largest dealer in electric supplies in this part of the state. The affairs of the company will be closed out.

NO COMPENSATION FOR YARD TRACKS.—The Interstate Commerce Commission has dismissed the complaint of the General Electric Company against the New York Central & Hudson River and the Delaware & Hudson Companies, which asked for compensation for use of factory yard tracks at Schenectady. The Commission rules that "common carriers are under no duty to extend their transportation obligations, with the extension of great industrial plants, and to accept and deliver cars within the inclosure over a network of interior switching tracks constructed as plant facilities to meet the requirements of the industry." The General Electric Company sought compensation to cover the cost of the movements of loaded and empty cars between the interchange tracks and certain shops, foundries and other buildings within

the inclosure of the plant. The commission holds it is not entitled to this compensation. Commission Harlan, who wrote the opinion for the commission, decides that whereas in this case a manufacturing plant has so increased in size as to require within the plant inclosure 12 miles of broad gage switching tracks and seven miles of narrow gage electric tracks for prompt and economical operation, and with its own facilities and crews does a vast amount of internal switching which would be seriously interfered with by the switching engines of the railroad if permitted access to the plant, and has on that account assumed charge of the switching, it is not entitled to pay from the railroad company. The commission held on the facts of the case that the complainant does nothing within its plant inclosure which it can lawfully call upon the defendants to do for it and therefore nothing for which it may lawfully demand compensation, under the circumstances shown of record the obligation of the defendants to complainant involves only an acceptance and delivery of cars at some reasonably convenient point of interchange. The commission holds it has no power either to enforce the specific performance of contractual obligations or to award damages for the breach of such agreements between carriers and shippers.

FURTHER KELLOGG TELEPHONE DECISION.—The Appellate Court of Illinois, First District, has filed an opinion reversing the decree of the court below, which held that the complainants, Dunbar et al., in their suit against the American Telephone & Telegraph Company were entitled to vote the stock in dispute between Barton and Kellogg. The upper court held with Judge Windes, of the Circuit Court, that the material allegations of the bill of complaint were proved, but held that the relief granted should extend only to an injunction against the voting of the stock in question and against its receiving any further dividends on the stock of the Kellogg Switchboard & Supply Company. The court gave as its opinion that the 1907 stockholders' meeting did not elect directors, because neither Kellogg not Barton had the right to vote 3307 shares of stock of which the ownership is in dispute. Eliminating these shares of stock, there was not a quorum and, therefore, the election was illegal. Therefore, the decree of Judge Windes in declaring the Kellogg board of directors elected is held to be erroneous. In suggesting relief to which the complainants are entitled the decision says "that the complainants have no stand to insist upon any relief beyond that which is necessary for their own protection against injury. Such protection will be fully met by an injunction against Barton and the American Telephone & Telegraph Company from voting the shares of the Kellogg stock purchased from Milo G. Kellogg and others and from acquiring or attempting to acquire any stock of the Kellogg company and voting it at any stockholders' meeting and from exercising or attempting to exercise any control, direction, supervision or influence over the acts of the Kellogg company; and by enjoining the Kellogg company from permitting the stock to be voted by the American Telephone & Telegraph Company and from paying any dividends to be hereafter declared on account of such stock to the American Telephone & Telegraph Company or to any corporation or person for it. This was the relief given in the United States vs. Northern Securities Company." It is understood that the case now goes to the Supreme Court of Illinois in October.

Personal.

MR. A. BEMENT, consulting mining and mechanical engineer, Chicago, has moved his offices to the Fisher Building, that city.

MR. O. CLEMENT SWENSON, treasurer of W. S. Barstow & Co., engineers, has sailed for Europe, to be gone until the latter part of August.

MR. SIDNEY H. WHEELHOUSE, sales manager of the Westinghouse Machine Company, has become the Pittsburg sales manager for the Hooven-Owens-Rentschler Company, his appointment taking effect on the first of this month.

MR. CHARLES B. PEAR, formerly manager of the Albert & J. M. Anderson Manufacturing Company and now with the Atlantic Marine Company, Boston, was married July 9 to Miss Ellen E. Locke, of Gloucester, Mass., daughter of Mr. and Mrs. Francis Locke.

MR. J. E. JEFFRIES, of Alexandria, Ind., who is interested in several light and power enterprises in Indiana, has been paying a summer visit to New York and speaks very hopefully of the active resumption of development in the field now that money is obtainable for both old and new systems.

MR. KURT R. STERNBERG, general manager of the Dickinson Manufacturing Company, Springfield, Mass., has recently returned from an extended trip in Europe, and arranged while there for the manufacture and sale in the United States of several new insulating materials and other products for the electrical trade.

MR. ADOLPH A. THOMAS has been made an associate in the office of Brown & Williams as an assistant in their patent practice, 1550 Monadnock Block, Chicago. He is a graduate in chemical engineering from the Case School and in law from Georgetown University. For four years he was an assistant examiner in the electrical division of the U. S. Patent Office. He will devote his attention to interferences and to applications in the chemical, electrochemical and alternating-current fields of invention.

MR. G. F. MANSBRIDGE, superintendent of the postal telegraph factory at Pleasant avenue, London, has returned to England after a trip to this country in the interests of his ingenious condenser. He visited New York, Philadelphia, Baltimore, Washington, Pittsburg, Chicago, Cleveland, Buffalo, Rochester, Albany, Boston and Montreal, taking passage home from the last-named city. The condenser was received, he says, "almost with enthusiasm, and the prospects are excellent."

MR. JOHN W. CARTER, general superintendent of the Kansas City Railway & Light Company, of Kansas City, Mo., has resigned, and Mr. William E. Satterlee, assistant general manager, has been appointed to succeed him. Mr. Carter will hereafter devote all his time to farming.

MR. J. S. DILL, of Youngstown, Ohio, has been appointed general manager of the Elmira Water, Light & Railroad Company, of Elmira, N. Y., to succeed Mr. W. W. Cole recently resigned. Mr. Dill will assume his duties in Elmira about Aug. 1.

MR. C. S. DAVIS has been appointed superintendent of the Marlboro Electric Company, of Marlboro, Mass., to succeed Mr. E. W. Godfrey, resigned. Mr. Davis has been connected with the Holtzer-Cabot Electric Company, of Boston, Mass., and will take charge of the plant on Aug. 1.

MR. A. J. MARSHALL has severed his connection with the engineering department of the Holophane Company and has become chief consulting and designing illuminating engineer with the Bureau of Illuminating Engineering, 437 Fifth avenue, New York. Previous to his three years with the Holophane Company Mr. Marshall was connected with the Baltimore branch of the Welsbach Company. Mr. Marshall has lectured extensively on the fundamental principles of his profession, in a trip covering a period of some nine months and 26,000 miles, some 50 or 60 lectures being given in various parts of the United States.

Trade Publications.

STROMBERG-CARLSON.—The Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., has issued a neat set of printed postal cards illustrating its factory in that city. The views are made from photographs taken in the summer time and show the factory to be as attractive as the apparatus it turns out.

TRUMBULL CHEER for July, issued by the Trumbull Electric Manufacturing Company, of Plainville, Conn., is pithy and timely, with some excellent talk on the subject of switches. Five separate policies are outlined as to the making of knife switches. A decided novelty is the supplement to the bulletin showing a 37½-in. halftone of a 60-ft. switchboard of Trumbull construction. It is an impressive picture.

Unclassified Items.

(Items received too late to classify under Construction News, etc.)

DELMAR, N. Y.—Proposals will be received until Aug. 12 by the Town Board of the Town of Bethlehem for lighting the streets of Delmar. Forms of proposals and specifications can be obtained at the office of the town clerk at Slingerlands, N. Y. George J. Coughtry is town clerk.

MADISON, WIS.—Bids will be received by the Wisconsin Capitol Commission until July 28, for furnishing and installing the electric lighting fixtures required for the west wing of the Wisconsin capitol building now under construction at Madison. Specifications and blank proposal forms may be obtained from George B. Post & Sons, 347 Fifth Avenue, New York, N. Y., architects, or from the secretary of the Capitol Commission. Plans and specifications may also be examined at the following places: Office of the American Contractor, Chicago, Ill.; Builders' & Traders' Exchange, Milwaukee, Wis., and at the Builders' & Traders' Exchange, Minneapolis, Minn. Lew F. Porter is secretary of Capitol Commission.

NEWBURGH, N. Y.—The Newburgh Light, Heat & Power Company has entered into a contract with the Grove Mills Paper Company to furnish it with electricity for operating the paper mills. The contract calls for between 300 and 400 hp with a 24-hour service.

MONTGOMERY, ALA.—The Alabama Railway & Electric Company has been chartered with a capital stock of $200,000 to construct an electric railway from Anniston to Dothan.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Gallatin Pike Railway Company with a capital stock of $25,000, by E. B. Rucker, C. H. Gillock, M. H. Sharp, P. A. Shelton and J. H. Zateer.

THE PELOUZE ELECTRIC HEATER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $25,000 by Isadore S. Blumenthal, Jacob E. Dittus and Lillian Olsen. The company proposes to manufacture electric heaters.

EDWARDS & COMPANY, of New York, N. Y., has been incorporated with a capital stock of $75,000 by Robert Edwards, Jr., Edward Lungen and Robert C. Mead, all of New York, N. Y. The purpose of the company is to manufacture electrical apparatus, machinery, etc.

CUMBERLAND, WIS.—The citizens have voted in favor of the proposition to borrow $25 000 from the state trust funds for the purpose of installing a new electric light plant and water works system, build a city hall and other improvements, work on which will begin at once.

PINE BLUFF, ARK.—The property of the Pine Bluff Light & Water Company, including the gas, electric light and water plants, was sold July 9 to Ralph L. Crump, of New York, N. Y., representing the Equitable Security Company, of New York, N. Y., for $450,000. The sale was under the authority of the United States Court, and Mr. Crump represented the bondholders. The plant is now being reconstructed, and it is said no change will be made in the plans.

FAYETTEVILLE, N. C.—The city has accepted the proposition offered by the Little River Power & Transmission Company to supply the city with electricity for lighting and other purposes.

LENOIR, N. C.—It is stated that electrical power from the Catawba River will soon be brought into the town, which will be used to operate the manufacturing plants and other industries.

WILSON, N. C.—Specifications are being prepared for an addition to the municipal electric plant to meet increasing demands for electricity for motors. The cost of the improvements is estimated at $10,000.

GEORGETOWN, S. C.—Plans are on foot looking to the establishment of an electric railway system in Georgetown. Electricity for operating the plant to be secured from the present lighting plant, of which L. Mouzon is manager. It is proposed to operate the lighting and street railway systems under the same management.

CHARLOTTE, N. C.—The Southern Power Company, of Charlotte, has recently perfected arrangements for supplying electrical energy to the following cotton mills and factories: The Linden cotton mills, Davidson, N. C.; the Dilling cotton mills, King's Mountain, N. C.; the Patterson Manufacturing Company's cotton mill at China Grove, N. C. The town of China Grove has also contracted with the company for electricity for street lighting.

INDE, MEX.—The Inde Gold Mining Company, of Inde, has obtained a concession from the Federal Government to install a hydro-electric plant on the Nazas River.

SAN IGNACIO, MEX.—The Compania Minera Jesus Maria y Anexas will install a hydro-electric plant on the Sinaloa River near the town of San Ignacio. The power will be used to operate the machinery of the mine and mill of the company.

MEXICO CITY, MEX.—Steps have been taken by Parry Gosset and associates to install a hydro-electric plant on the Piaxtla River in the State of Durango. The power will be used by mines and industries of that locality.

MEXICO CITY, MEX.—The Federal Government has granted Nemesio Ponce a concession for the installation of a hydro-electric plant on the Angulo River in the State of Michoacan.

Business Notes.

W. G. CARTER & CO., electrical contractors, Ashlan, Pa., have dissolved partnership. The firm consisted of Frank K. Russell and W. G. Carter.

WYCKOFF PIPE OFFICE.—The Wyckoff Pipe & Creosoting Company have opened offices at 50 Chuch Street, New York, which will be the main office instead of Stamford, Conn., as hitherto.

WOOD PRESERVATION AND WORKING.—Mr. E. E. Chapman, formerly of the Akron Wood Working Company, of Akron, Ohio, and of the Sandusky Grille Company, has taken a position with the Federal-Harris Manufacturing Company as superintendent.

CATALOGUES WANTED.—R. L. Matthews Electric Company, North and Mill Streets, Newcastle, Pa., requests that catalogues of all kinds be sent to it with reference to electrical supplies, dynamos, motors, switchboards, etc. The firm has been in business for several years.

CASS HARKINS & SON.—The DuBois Iron Works, DuBois, Pa., advise that Mr. Robert R. Harkins, their representative at Cleveland, has associated himself with his father, Mr. Cass Harkins, formerly manager of the Atlas Engine Company, Columbus, Ohio. The firm name will be Cass Harkins & Son, with offices at 1419 Schofield Building, Cleveland, Ohio.

RIDGEWAY APPARATUS.—In order to take care properly of growing business in the South, the Ridgeway Dynamo & Engine Company has concluded negotiations with the Machinery Sales Agency, Room 1021 Prudential Building, Atlanta, Ga., to handle its complete line of side and center crank engines, as well as the well-known direct-current electrical generators, etc.

WILL OPEN SEATTLE BRANCH.—The Sprague Electric Company with general offices at 527 West Thirty-fourth Street, New York City, and branches in many cities, has opened a new branch in the Color Building, Seattle, Wash. This is the second branch the company has placed on the Pacific Coast, having had an office in San Francisco for several years. The new branch will be in charge of Mr. W. R. Hendrey, who has heretofore been connected with the San Francisco office.

THE ELECTRIC CONTROLLER & SUPPLY COMPANY, of Cleveland, Ohio., has changed its name to the Electric Controller & Mfg. Company. The latter name more truly indicates the nature and scope of its business as evidenced by the following list of apparatus manufactured by the company: controllers, both manual and magnetic switch types, for all purposes, lifting magnets, electric brakes, magnetic switches, solenoids, limit stops, arc welders, crane fittings, knife switches, flexible couplings, the electric fault finder.

ELECTRIC WELDING PRODUCTS COMPANY.—Owing to the increased call upon it for completely finished valve stems and other similar work, The Electric Welding Products Company, of Cleveland, Ohio, has recently installed a grinding and finishing department, consisting of several Brown & Sharpe plain and universal grinders, special imported machines for spline milling or slot cutting, as well as centering machines. With the aid of this department the company is able to turn out a product finished in every detail. For example: A gas engine valve stem is ground on both seat and stem; slot, groove or thread is cut, or hole drilled and the end hardened, so that it is all ready to slip into an engine in the assembling room. A majority of the large manufacturers are grinding their valve stems and many other parts to insure an accurate fit and wear."

THE INDUSTRIAL INSTRUMENT COMPANY, of Waterbury, Conn., has purchased the Van Choate Electric Company's plant in Foxboro, Mass., which was sold a few years ago to the Schaeffer-Budenburg Manufacturing Company, of Magdeburg, Germany. The instrument company manufactures steam gages, thermometers and recording instruments, and is planning to occupy the premises immediately. The Schaeffer-Budenberg Manufacturing Company is to move its business to a large plant, which is under construction near New York City, N. Y.

THE MASSACHUSETTS CHEMICAL COMPANY, of Walpole, Mass., have just placed upon the market two new brands of friction tape which are quite remarkable in their characteristics. The numbers of these friction tapes are 310 and 311 respectively, the former being cut straight and the latter cut on the bias. These tapes run 230 ft. to the pound and gage .011 in thickness. They are made of a special twisted cloth and are exceedingly strong. The compound with which they are impregnated and coated is neutral and will not deteriorate the fabrics. These tapes are primarily manufactured for armature coil taping and for this purpose are, it is said, much more efficient and more conveniently handled than the ordinary webbings, the straight tape being used on the portion of the coil which goes in the slots and leads, while the bias tape is used on the curls of the coil. No danger need be feared from the work slipping while in process of taping and the very annoying feature of dropping a roll of webbing on the floor and having it roll out is impossible, of course, with this friction tape. Moreover, it has a high dielectric strength in itself and is also manufactured to combine with insulating compounds and make a most thorough and workmanlike job. The thinness of this material will appeal to those who are taping coils to be inserted in the narrow slots in armatures, and the bias tape will turn corners so readily that the work will lie absolutely flat.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 7, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

892,400. ACTION FOR PNEUMATIC PIANO PLAYERS; Erick Carlson, Chicago, Ill. App. filed Feb. 18, 1907. Construction of valve or action for pneumatic pianos, designed to strike and release the keys quickly. Has a return duct from each primary for the escape of surplus air, which prevents the quick return of the primary after being actuated.

892,410. SWITCH MOUNTINGS; Arnold E. de France, Toledo, O. App. filed Oct. 4, 1907. Construction of snap switch having projecting lugs adapted to recive fastening screws at its four corners.

892,411. INSULATED COUPLING FOR ELECTRIC CONDUCTORS; John J. Dossert, New York, N. Y. App. filed March 8, 1906. A connector for cables, having two hollow threaded members which engage over octagonal heads at the ends of the conduit pipes.

892,417. PLATING MACHINE; Charles Glover, New Britian, Conn. App. filed Oct. 22, 1907. Has a tank with a rotatable frame therein, and a series of independent means each comprising an electrode carried by said frame and adapted to support one or more articles to be plated.

892,419. SYSTEM OF ELECTRIC MOTOR CONTROL; Fletcher D. Hallock, Wilkinsburg, Pa. App. filed Dec. 3, 1906. A means for starting relatively large motors and at the same time eliminating the possibility of injuring their wingings. Has a plurality of knife blades which are opened in a predetermined order. Has a specially arranged magnetic cut-out.

892,421. SYSTEM OF ELECTRIC MOTOR CONTROL; Ford W. Harris, Wilkinsburg, Pa. App. filed Sept. 5, 1905. A system having a set of successively closed switches designed to automatically open a main circuit if the switches of the set are closed in other than the regular predetermined order.

892,425. WATER LEVEL INDICATOR; William Crocket Horner, Nashvile, Tenn. App. filed Feb. 13, 1908. A low water level indicator making use of a casing including an electric bell and a dry battery, and having a projecting arm to which a float is attached.

892,429. SYSTEM OF ELECTRIC MOTOR CONTROL; Henry D. James, Pittsburg, Pa. App. filed Nov. 3, 1906. Means for controlling the starting resistance of relatively large electric motors. Has a system of switches or contactors operable by separate handles and electrically interconnected to prevent their improper actuation.

892,441. ELECTROTHERAPEUTIC GENERATOR; Samuel M. Metzler, Indianapolis, Indiana. App. filed March 9, 1908. A generator for oxygenating and medicating live steam. Provides a generator by which medicone can be effectively administered to a patent by inhalation.

892,464. CONTROLLER; Emmett W. Stull, Norwood, O. App. filed June 30, 1906. A means for preventing flashing at the contacts of railway controllers. Particularly designed to avoid flashing at the controller contacts when the car is being "notched" along. Has a magnetically operated switch arranged to be opened when the controller is moved backward into its first operative position.

892,470. SYSTEM OF DISTRIBUTION: Hermon L. Van Valkenburg, Norwood, O. App. filed Sept. 29, 1906. A system of distribution

particularly adapted to ammeter connections for polyphase systems. Has means for transferring an ammeter from one circuit to another or from one phase of a polyphase system to another, whereby none of the series or current transformers can possibly be open circuited.

892,475. ARC-LAMP REGULATING MECHANISM; Ernest P. Warner and Carl Wiler, Chicago, Ill. App. filed Jan. 15, 1906. In an electric arc lamp, the combination with a movable carbon, of a solenoid provided with an armature, a retarding device, the paths of movement of said carbon, armature and retarding device being parallel, and a lever connected at one end with said carbon, at the other end with said retarding device and intermediate its ends with said armature.

892,477. SIGN FLASHING APPARATUS; Gustaf Wesley, St. Paul, Minn. App. filed March 7, 1905. Electric sign flashing apparatus having means for electrically controlling and lighting lamps or groups of lamps. Consists particularly in providing improved positively-operated means for breaking and making electric circuits. Has a plurality of knife switches surrounded by a rotary ring, and cams carried by said ring to successively engage with and close said switches, and means for rotating said ring.

892,486. PROCESS FOR PURIFYING WATER AND SEWAGE; Albert Edward Woolf, New York, N. Y. App. filed Jan. 11, 1908.

892,554—Shunt.

Consists in adding a small percentage of electrolytically produced disinfecting solution to the liquid prior to complete filtration.

892,487. TURBO GENERATOR CONSTRUCTION; Alfred H. Wouters, Norwood, O. App. filed Nov. 3, 1906. Construction of hood or cap for the ends of the armatures of turbo generators to prevent the coils being displaced by centrifugal force.

892,500. BATTERY INDICATOR; Rufus N. Chamberlain, Depew, N. Y. App. filed Nov. 11, 1903. An indicator for use in charging storage batteries, adapted to give different voltage rates when a battery is slowly charged from when it is charged rapidly, so as to correct for the variable back pressure in the two instances.

892,516. PROCESS OF PRODUCING CONCENTRATED NITRIC ACID; Birger Fjeld Halvorsen, Christiania, Norway. App. filed Feb. 9, 1906. A method of producing concentrated nitric and concentrated sulfuric acid from nitroso sulfuric acid and notrosyl sulfuric acid.

892,554. SHUNT; Frank W. Roller, Plainfield, N. J. App. filed June 9, 1905. Construction of ammeter shunt adapted to radiate heat rapidly.

892,557. RAIL JOINT; Howard S. Shafer, Nazareth, Pa. App. filed July 11, 1907. The abutting ends of the rails are drilled in directions in alinement with one another and receive a pin or plug having solid wire connections with the respective rails.

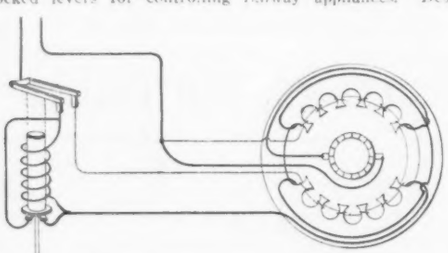
892,572. SIGNAL DEVICE; Joshua W. Atlee, Riverton, N. J. App. filed Jan. 11, 1906. Has means for displacing an illuminated signal during a blast of the whistle of a boat, so as to provide a visual in addition to the audible signal.

892,576. TIME LIMIT CIRCUIT CLOSER; Walter W. Brown, Schenectady, N. Y. App. filed Dec. 26, 1907. Construction of circuit closer by which flexible leads and sliding contacts are avoided, and by which the circuit closure is protected from injury from the outside or by fracture from the movement of the mercury therein.

892,608. ELECTRIC BATTERY; William Morrison, Chicago, Ill. App. filed Aug. 11, 1902. A form of gravity battery making use of liquid bromin in a cellular carbon structure at the bottom of the jar or tank.

892,626. ELECTRICAL INSULATOR; Hugo F. Selinger, St. Louis, Mo. App. filed Dec. 12, 1907. An insulator for the leading-in wire of a transformer of the type having an overhanging ledge to shed water from its interior. The insulator has a cylindrical portion terminating in a grooved head.

892,636. CONTROLLING APPARATUS FOR RAILWAY APPLIANCES; Hiram C. Williams, Utica, and Francis B. Harrington, Albany, N. Y. App. filed Nov. 4, 1907. Relates to the control of interlocked levers for controlling railway appliances. Designed to



892,656—Controller for Alternating-Current Motors.

provide a time limiting device for insuring a certain interval between the operation of certain of the levers, in order that the switch may not be thrown without giving sufficient warning to an approaching train.

892,637. CONTROLLING MEANS FOR RAILWAY APPARATUS; Hiram C. Williams, Utica, and Francis B. Harrington, Albany, N. Y. App. filed March 25, 1908. Relates to modifications of the above.

892,655. BATTERY CHARGING APPARATUS; Frederick G. Duryee, Fort Wayne, Indiana. App. filed Dec. 17, 1906. Apparatus for automatically regulating the current flow from a source of supply to a storage battery. Includes details of the automatic cut-out switch.

892,656. CONTROLLER FOR ALTERNATING-CURRENT MOTORS; George W. Euker, Boston, Mass. App. filed Aug. 27, 1907. A complete controller for small alternating current motors, particulary adapted for use with a foot pedal. Includes a solenoid with a depressible core which varies the inductance of the winding, and finally cuts the winding out of circut when its inductance is at a minimum.

892,670. ELECTRIC SNAP SWITCH; Walter S. Mayer, Philadelphia, Pa. App. filed Jan. 2, 1907. A snap switch making use of a spring impelled blade which is released and moved abruptly by a detent which is displaced upwardly by a lever when the switch button is turned.

892,677. SAFETY APPLIANCE FOR ELECTRIC RAILWAY TRAINS; Edwin T. Munger, Chicago, Ill. App. filed Dec. 2, 1907. Has means for preventing the application of any current to the motor or motors of a train until the brake-operating devices have been placed in proper position for the exercise of the motor control.

892,712. SAFETY APPLIANCE FOR ELECTRIC RAILWAY TRAINS; Adolph H. Daus, Chicago, Ill. App. filed Dec. 2, 1907. Relates to modifications of the above.

892,713. SAFETY DEVICE FOR ELECTRIC TRAINS; Adolph Daus, Chicago, Ill. App. filed Dec. 30, 1907. Relates to additional modifications.

892,721. ELECTRIC LAMP SOCKET; John H. Hanson, Chicago, Ill. App. filed June 3, 1907. A circuit switch of the type having a depending chain by which it is actuated to successively open and close its circuit.

892,734. SAFETY APPLIANCE FOR ELECTRIC RAILWAY TRAINS; Harley A. Johnson, La Grange, Ill. App. filed Dec. 2, 1907. Relates to the same general subject matter as No. 892,712.

892,749. ELECTRIC SIGN APPARATUS; Richard F. LeBrocq, Etna, N. J. App. filed Feb. 25, 1907. A clock-work operated apparatus for cutting the current in and out of any lamp or series of lamps as desired. Has a drum with segments rotated by a ratchet mechanism.

892,755. PLUG FOR ELECTRICAL CONNECTIONS; Walter S. Mayer, Philadelphia, Pa. App. filed Aug. 26, 1907. Construction of wall plug receptacle having the usual spring doors which close over the cavity of the switch whether or not the plug is in place.

892,763. INDUCTION COIL UNIT; Carl A. Pfanstiehl, Highland Park, Ill. App. filed Nov. 11, 1907. A wafer section for a built up induction coil.

892,764. HIGH FREQUENCY APPARATUS; Charles C. Ruprecht, Cleveland, O. App. filed Feb. 4, 1907. Covers details of high frequency apparatus for electro-medical use.

892,768. ELECTRIC-ARC LAMPS; Charles P. Steinmetz, Schenectady, N. Y. App. filed May 31, 1902. The combination in an electric arc lamp, of means for creating within the lamp a circular air current carry smoke and other products of combustion from the arc, and means for depositing said products at a predetermined point in the air circuit.

892,770. APPARATUS FOR GOVERNING THE PASSAGE OF CARS OR VEHICLES ALONG A RAILWAY; John D. Taylor, Wilkinsburg, Pa. App. filed Jan. 17, 1905. An indicating mechanism for the lever of an interlocking machine, including a motor having a centrifugal device and a connection therefrom to the latch for said lever.

892,814. ELECTRIC INDICATING SYSTEM FOR RAILWAYS; Herbert Grove Dorsey, Ithaca, N. Y. App. filed Nov. 5, 1907. Block signal system making use of a special track rail and specially constructed indicators on the locomotive and located in the motor circuit so as to provide a mutual induction on the trains as to the speed of other adjacent trains.

892,822. POLE TOP CAP; James William Fraser, Charlotte, N. C. App. filed Nov. 11, 1907. Pole top cap comprising a socket for receiving the end of the pole and having means engaged by an insulator pin. Has a lateral extension for supporting a protector wire.

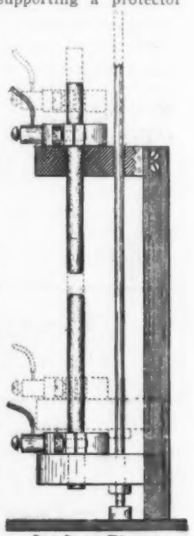
892,841. SYSTEM OF CONTROL; Henry D. James, Pittsburg, Pa. App. filed Sept. 3, 1907. A system of contractors having an electric motor having specially connected circuits by which they are automatically actuated in succession.

892,872. ELECTRIC SWITCH; Hervey H. McIntire, South Bend, Ind. App filed Sept. 27, 1904. Electric switch particularly for use in protographic printing machines where the lights are intermittently used. Designed to avoid corrosion of the metallic contacts.

892,874. OVERHEAD TROLLEY WIRE CROSSING; Richard C. McKiliget, New Orleans, La. App. filed June 18, 1907. Construction of crossing for trolley wires designed to insulate the lines from one another. The separate trolley wires are interrupted and hooked over lugs forming part of the cross arm fixture.

892,882. ELECTRIC SAFETY SIGNAL FOR RAILWAYS; John Pernat and Johan Kerkowitz, Cleveland, Ohio. App. filed Jan. 25, 1908. Signal in which alarm devices on approaching locomotives will be simultaneously operated the instant the locomotives enter the same block, so that the engineers wil be notified of the approach of another train.

892,928. SWIVEL-JOINT FOR ELECTRIC WIRES; Horatio A. Black, Toledo, Ohio. App. filed Oct. 24, 1907. A pair of telescoped tubes for axial rotation one upon the other and secured against longitudinal separation, a pair of contact plates insulated from each other and from the tubes and rotatable with one of said tubes, a pair of brushes rotatable with the other tube and in contact with said plates, a pair of wires connected at one end of the tubes with said plates, a pair of wires connected with the brushes at the other end of the tubes.



892,872—Electric Switch.

892,931. LIFTING MAGNET; Victor R. Browning, Nottingham, O. App. filed Dec. 14, 1906. Lifting magnet having a plurality of magnet coils and means for placing said coils in parallel or in series as may be desired.

912,828. RINGER FOR TELEPHONES AND THE LIKE; Elbert R. Hobbs, Lamar, Colo. App. filed Dec. 17, 1906. The combination of a magnet, a support-plate, mechanism connected with said supporting-plate and adjustable relatively thereto, said mechanism being provided with brackets, springs connected with said brackets and depending therefrom, an armature mounted upon said springs and free to rock by the resilience thereof, and means for adjusting the position of said brackets relatively to said supporting-plate.